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"The further backward you look the further foward you see."

—Sir Winston Churchill

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Letter From The Editor

by Regina Meani CFTe
STA, ATAA, APTA

"The further backward you look the further forward you see." Sir Winston Churchill's words resonated in my mind as I travelled to Egypt in November 2007 to join the 20th IFTA conference held at Sharm-El -Sheik. And without surprise, I note from the tribute on the following page that it was a favourite concept of Ian Notley's, one of IFTA's Founding Fathers.

Travelling to a land of such ancient history, we were all compelled to look back in time, which brings significant parallels to Technical Analysis. For many to define Technical Analysis, it is a process whereby history repeats itself with patterns and trends following similar paths over time. Coincidently, in such an ancient land we were watching the development of a new society within the Federation, an inspiring experience, epitomising the ability of TA to speak all languages and travel to all lands.

Well-themed, to prepare for a year of global market uncertainty, the Egyptian conference, "Middle East Energy, Commodities and the Globalisation of Financial Markets," provided the forum for active participation by the delegates. The 21st Conference to be held in Paris 2008 has identified the need to examine the multidisciplinary nature of analysis methods and has appropriately sought economists, financial analysts and fund managers to share their views and debate the reciprocal benefits of each discipline.

In this issue, we continue to recognise the high achievers within the IFTA accreditation programme, which is the premier internationally recognised certification for technical analysis. IFTA provides a two-tiered process whereby IFTA colleagues may sit initially for two successive examinations for the award of an international professional qualification in Technical Analysis as a Certified Financial Technician (CFTe). The exams tests technical skills knowledge, ethics and market understanding. The Master of Financial Technical Analysis (MFTA) is the second tier in the accreditation process and is intended as a rigorous test of professionalism within the global technical analysis field. The award of MFTA challenges the analyst to add to the TA body of knowledge and requires an original thesis-style research paper applied to multiple markets.

Of those recently awarded an MFTA, we have selected papers written on optimizing stop-losses, trading systems in volatile and declining markets, and a new look at Fibonacci retracements. These papers, included in the mid-section of the journal, demonstrate the high standards of achievement required for the MFTA designation. And in a reflection of the global market turmoil experienced in 2008, the papers revolve around the theme of redefining market entry and exit points.

From our other contributors, we present papers on trading strategies, profit optimisation and volume oscillators. We include a TA Comment from IFTA Director Peter Pontikis and a review of the *Encyclopedia of Candlestick Charts* by Thomas Bulkowski.

I would like to thank all those who have contributed to the journal, as I believe they have made an imprint on the TA Body of Knowledge. I would particularly like to thank my team of Roberto Vargas and Dr. Rolf Wetzer, who have indefatigably devoted many hours of their time to prepare a professional journal.

In Memoriam: Ian Sydney Notley

by Regina Meani

While I feel a great sadness, it is with great honour too, that I have the role of bringing together a tribute to Ian Notley. After his passing, many paid homage, and below I have pieced together just a few of those sentiments.

The world of technical analysis lost a favorite son on May 28, 2008, when Ian passed away in his 72nd year after fighting a courageous five-year battle against cancer. To quote his protégé, Jonathan Arter, at Yelton Fiscal, "We all knew Ian for his unflagging persistence, and he was no different in his struggle against this adversity. As it was in his life and professional affairs, so too was it in this. He was fully engaged."

We remember him fondly as the consummate, polite gentleman whose life and work left indelible impressions upon all who had the pleasure of his company.

In the early 1970s, Ian McAvity lured Ian to Toronto from his native Australia and pre-empted the launch of the Notley gospel on research into the secular and cyclical price movements of financial instruments.

After many years of working for several investment dealers in Toronto and New York, he moved in 1987 to Connecticut and started his own advisory firm, Yelton Fiscal Inc., often called the Notley Group. Yelton, of course, is Notley spelled backwards and reflects Ian's propensity to have looked at a chart upside down and back-to-front. Ian acquired a rabid following of investment professionals across Canada and the United States, Europe and South East Asia. He accumulated probably the largest private global data base. Ian would say, "The further back you look, the further forward you see."

Karl Wagner from Toronto says, "At Yelton, he had between 20 and 40 employees over the years, and I've never seen such loyalty in any company of any size in any industry."

"It was an honour to have known him," concludes Karl, "as the *Doctor of Momentum* and a *Prince of the Investment Business*."

Ian's selflessness pervaded our industry as he labored determinedly to promote technical analysis and was an inspiration to many aspiring technicians. He was tireless in his supporting role as a founder of the Canadian Society of Technical Analysts (CSTA), and IFTA. The Walkabout, his unique creation, became a brilliant ice-breaker at the start of every conference. At the 2007 IFTA conference in Egypt, he presided over his final Walkabout, but his legacy lives on.

His peers recognised his accomplishments with many awards. In 1993, he was awarded a Life Membership in the Society of Technical Analysts (UK), and in 1997, he received the "Best of the Best" Award for Cycle Wave Analysis by the Market Technicians Association (MTA) in New York. For "outstanding contribution to the development of technical analysis," Ian was presented with the A.J. Frost Award by the CSTA in 2002, and two years ago, he was honoured again with the MTA Annual Award "in recognition of work that breaks new ground or makes innovative use of established techniques."

Claude Mattern of the French Society (AFATE), recalls that Ian had a hardcover book with his name as the author called, "*All I Know About Technical Analysis*," but all the pages in the book were blank. "He was a great man," says Claude. On that, we can all agree.

With thanks to Ian McAvity, Ron Meisels and Bill Sharp for their contributions
Ian is a Founding Member of the CSTA and a frequent presenter at IFTA Conferences.
Ron is a Founding Director and 1st President of the CSTA and was a Director of IFTA.
Bill is a Founding Director and 3rd President of the CSTA, a Past Chairman of IFTA and currently sits on the IFTA Board of Directors.

Education and Comment

Technical Analysis in Emerging Markets

by Peter Pontikis

We analysts in the so-called developed world financial markets are familiar with the emerging market asset class. The term is sometimes loosely used as a replacement for *emerging economies,* but really signifies a business phenomenon that is not fully described by, or constrained to, geography or economic strength. Such countries are considered to be in a transitional phase between developing and developed status.

The emerging markets are by no means "new;" some of the geographies we normally refer to are societies and economies that have a long trading experience but, in our accepted sense of securities and derivatives trading in deep and liquid markets, are "emerging" from a more basic architecture of market form. They are though, by common usage, regions of the world which are experiencing rapid informationalisation (if not industrialisation). Emerging markets, as such, lie at the intersection of non-traditional financial markets, the rise of investor groups and communities in the process of adopting products and services, and innovations in product technologies and platforms.

The phenomena of the rise and multiplication of emerging markets is a two-way street. It not only opens up access for emergent market investors and traders to developed world markets, but also opens up their markets to the world with all its resultant volatilities that come with the interplay of inexperienced markets colliding with like investors and traders regardless of origin, developed or not.

It will, by definition, involve a two-way transfer of skills—where developed market trading methodologies migrate to the "new" markets and their local participants while the "new" markets themselves present the challenge of markets in evolution that demand accommodation by those seeking to profit from these new markets and their salient trends.

For technical analysis (TA) and IFTA, the first and foremost necessity in the emerging market (EM) space is the dissemination, via academic and private sector means, of rigorous and disciplined adoption and acceptance of TA's main tenets. Our goal is to ensure that the long developed skills and knowledge of TA are adopted according to global norms in these new markets. This is a challenge that IFTA and of course local societies actively attempt to meet in many regions.

This developmental role, that IFTA has for many years promoted, is not just about the promotion of arcane techniques, but also about the promotion of the ethos and ethics of price/volume analysis as a practical complement to fundamental value techniques. It is an ethos and methodology that, from personal and collegial experience, has and will continue to find a ready ear and adherents in our new market partners. Our peers must take note as this is the growth area for TA into the 21st century.

But beyond the informationalisation of EM participants, there are environmental considerations that all analysts must respect in these new markets

Beyond cultural awareness and sensitivity, there is the more methodological and essentially two-fold challenge of TA that is engaged—that of both a liquidity and an institutional nature.

EMs, by definition, are relatively small in terms of "main" or developed world markets' volumes, and this presents a problem of illiquidity such that small value amount trades may have disproportionally large impacts on price. This is not just a problem in relation to entering markets but also exiting them, where the displacement effect may, and often does, incur an additional cost of deployment in the EM landscape.

The lack of liquidity not only magnifies the endogenous volatility of a market, but also the smaller sample size of price data in many cases makes mathematically-based models more problematic in terms of their reliability. Statistically, it makes them more "risky" from a market endogenous point of view.

There is also, of course, often the lack of a large historical base, something that will tend to detract from the efficacy of technical methodologies.

Indeed, even if there is a large base of data to draw on, one must not lose sight of the fact that EMs, almost by definition, are those structurally breaking from their "past" trends and growth trajectories. In essence, it renders past correlations null and void in many cases; a facet that denies both fundamental and TA a large slab of their assumed basis.

We can say on this point, an EM, by virtue of its reduced scale and sample size of historical experience, presents a challenge that established markets do not necessarily provide, that is an automatic frame of reference either from a portfolio point of view or of a more micro/indicator level of assistance. Guides they will be by all means, but it would be dangerous to automatically download the traditional tried and tested techniques of "old" markets into the new and emergent shells.

There is here the challenge of accommodating emerging market "needs" to fit into the established tenants of TA. Before we go on, there is the other aspect of the "new" markets—that of their own institutional or local quirks.

By institutional, we mean there are inhibitors to trading in ways not normally encountered in the modern developed world (but historically had also once been a facet in those markets, as well). Examples of this include the prohibition on, for instance, short selling of stock and securities and also bans or restrictions on the use of derivatives.

Each of these institutional limitations, for instance on short selling and derivatives in general, have the effect of biasing dynamic price paths such that bear markets tend to be of a far more magnified nature compared to that of bull markets, as well compounding the observed asymmetric of relative price trends behaviours of a positive versus a negative nature.

Indeed as we go to press, the banning of short selling has gained something of a renaissance, if UK and US securities regulators are to be followed.

Thus what we are saying here is that for TA to be effective in the EM landscape, we must adapt, adopt and accommodate TA techniques to account for the EM characteristics, both generally and specifically.

For instance, a peculiar feature of emerging markets is its regard as having "growth" characteristics (or at least promise of them), making fundamental/value analysis in this instance, while a robust framework, not the most reliable nor the only methodological approach to investing and trading success.

Indeed, there is an idiosyncrasy in that general investment flows tend to (like the business cycle, too) perennially visit (and exit) the emerging market space. Taken as given, it is regarded as a higher risk asset class in general. That is, it can be broken down further into equity and debt market spaces and, of course, even further as the specialist analyst/trader would like to take down to the single security or bond. Assets and securities (as in the main markets) are related and inter-related silos of investment choice.

It is in this context that one of the more recent advances in TA, that of inter-market technical analysis of asset markets, becomes a relatively more valuable tool to the less researched, let's say "periphery," markets as we find in EM.

Emerging or "periphery" markets as "growth" markets, given they have the quality of an equity asset class, will disproportionally benefit from global up-swings and conversely have tended to be punished more so in down-swings. It is also (but not always) the opposite of "safe haven" asset classes and geographies.

Indeed, some of the characteristics of emerging markets we can schematically summarise such as:

- High risk (both up and down)
- Relatively higher cost to enter and exit
- Regulatory constraints may be evident.

- Low relative volumes and/or liquidity with often small numbers of significant active players
- Small in absolute volume, dependant on foreign asset allocation decisions for incremental traded volumes
- Inversely correlated to low risk/developed markets
- Or alternatively may, in fact, take their very lead from close proximity "main markets"
- Can be grouped geographically and/or
- By basis of some key, for example, commodities either as a whole or on a single commodity basis, as the OPEC/non-OPEC oil exporting markets

We mention the above points only as a start and as building blocks for developing frameworks in which market traders and analysts may approach particular periphery markets and, indeed, for emerging market analysts and traders to more correctly situate trends in their markets within the broader context of a globalised market place and trends.

At this point, we need to give a closer inspection of EMs and their sub asset classes, as they tend to have observed close correlation with other "like" asset grouping countries. Now, it is this sheer diversity of the periphery markets that presents the real challenge to TA and, indeed, to all analysts to unlock the potential in the phenomena of small/periphery market correlations. Both from the point of view of discerning leading or lagging phenomena, as well as being able to evaluate oversold or, indeed, overbought correlated markets. All this is in addition to picking the veritable turning points in minor and major price cycles.

So what can TA and its practitioners do with the flux and rise of emerging markets? For one thing, we must not take for granted that the price relationships and methods of developed markets will work TA techniques automatically in the EM space without some degree of sensitivity or accommodation to local institutional conditions and constraint. Analytical, financial or, indeed, cultural arrogance is a luxury neither side of the developed/emerging market dichotomy can afford. Both sides are on a learning process of dynamic discovery. An open and enquiring mind here is the best methodological starting point to improving our techniques and performance in the EM world. And if our techniques don't work, we must create new ones.

Secondly, the issue of EMs' relatively small and unstable sizes, (subject to foreign asset allocation trends – whims) must not be underestimated. Liquidity and changes in flows will have impacts on EM markets, and all too often the rationale comes from another related market that may transcend geography, asset class or, indeed, logic. Just observe the recent effect that US financial market volatilities in late 2008 have had on the periphery markets as a guide to the above point.

Of course, the EM asset class, by definition, is new and, as such, an opportunity for us all to take our body of TA knowledge and creative adaptive abilities to apply it to this infinitely more challenging and diverse set of markets. We may/will find in the course of our EM research efforts, old groupings, definitions, correlations and even techniques will need refurbishment as the challenge of globalisation in the financial markets challenges us all at the pointy end of the markets' evolution. Emerging markets that cannot be ignored, as they now grow in both absolute and relative terms before our eyes.

In summary, in keeping with the fundamental shifts in 21st century global financial flows that move increasingly in favour of the more faster growing "emergent" economies, the foremost challenge to technical analysis is that it embraces the challenge of application, adoption and accommodation to the broadening church of our techniques.

Allied with this, it is also hoped that the momentum of education and dissemination be kept apace. In this, we will likely find a ready acceptance and much mutual gain in our new and potential society partners. That said, all of us must now be respectful, if not cognizant, of the peculiar environment and parochial needs of technical analysis practitioners in the emerging economies. We have much to learn from each other. IFTA

Book Section

Encyclopedia of Candlestick Charts

by Thomas Bulkowski—Reviewed by Larry Lovrencic and Regina Meani

It took less than an hour for Thomas Bulkowski to "fall in love with" the Japanese Candlestick charting method. It took him many years of research to work out which Japanese Candlestick chart patterns work best.

Following some early success using the Japanese Candlestick method, Bulkowski experienced what many traders who are new to a technique had experienced: the methods fail dismally at times. The more that he used the method, the more he began to distrust it.

So, what did he do? Give up? That's what many traders would do.

Not Bulkowski. He knuckled down and did his own research, analysing more than 4.5 million candle lines to find out how Japanese Candlesticks work. The result of his effort is this book, *Encyclopedia of Candlestick Charts.*

This book is a handy reference for beginners to advanced Technical Analysts. It contains statistical data for the performance of over 100 Candlestick patterns in both bull and bear markets, offers identification guidelines, and explores the performance of tall versus short candles and shadows. It also describes which entry methods offer the better trading signals and how the combination with a Moving Average indicator can improve performance.

The structure of the book involves a chapter-by-chapter look at the behaviour and rank of the pattern both from a psychological and comparative view; how to identify the pattern; statistics on volume and height; strategies to maximise profit and minimise risk; and theoretical trades to allow the reader a closer insight into the patterns value. A Best Performance Table with tips is also included.

Of particular interest are the chapters which delve into important discoveries and those which explain each Table entry in detail and discuss the methodologies behind them. A useful addition is the visual index, which is a simple and effective guide to the candlestick patterns that may be used as a later reference point along with the glossary of terms.

Along the path to completion of this book, Bulkowski claims that he made several important findings:

- A number of candlestick patterns do not work as expected;
- Gaps don't work well as support or resistance;
- Candles with long bodies sometimes act as support or resistance;
- Tall candles outperform short ones;
- Candles with tall shadows outperform those with short ones;
- Candle volume is a poor predictor of performance except for breakout volume;
- Reversals patterns perform better than continuation patterns;
- Most patterns perform better in a bear market; and
- Price must have something to reverse.

Overall the easy to read style makes this book a welcome addition to most Technical Analysis bookcases.

Thomas N Bulkowski has more than 25-years of experience in trading and investing. He is a frequent contributor to various publications, including *Active Trader; Stocks, Futures & Options* and *Technical Analysis of Stocks & Commodities*, publishing nearly 100 articles. He has authored three other books, including *Getting Started in Chart Patterns, Trading Classic Chart Patterns*, and the *Encyclopedia of Chart Patterns*"(2nd edition). Before retiring at an early age, he was a hardware designer and software engineer. IFTA

Inferring Trading Strategies From Probability Distribution Functions

by John Ehlers

Abstract

Probability Distribution Functions are described, and Probability Distributions measured on market data are presented. The Probability Distributions vary with the specific data, as well as the techniques used for detrending. The measured Probability Distributions infer different logical applications of trading rules. When the Probability Distributions are Gaussian-like, one can anticipate turning points based on variation from the mean. Otherwise, the data could be cyclic and, therefore, turning points can be based on the cyclic period. If the data are random, the Fisher Transform can be employed to better identify the statistically significant turning points. Trading results based on these principles are presented and compared with conventional approaches.

Introduction

The primary purpose of technical analysis is to observe market events and tally their consequences to formulate predictions. In this sense, market technicians are dealing with statistical probabilities. In particular, technicians often use a type of indicator known as an oscillator to forecast short-term price movements.

An oscillator can be viewed as a high pass filter in that it removes lower frequency trends while allowing the higher frequencies components, i.e., short-term price swings, to remain. On the other hand, moving averages act as low pass filters by removing short-term price movements while permitting longer-term trend components to be retained. Thus, moving averages function as trend detectors, whereas oscillators act in an opposite manner to "de-trend" data in order to enhance short-term price movements. Oscillators and moving averages are filters that convert price inputs into output waveforms to magnify or emphasize certain aspects of the input data. The process of filtering necessarily removes information from the input data, and its application is not without consequences.

A significant issue with oscillators (as well as moving averages) for short-term trading is that they introduce lag. While academically interesting, the consequences of lag are costly to the trader. Lag stems from the fact that oscillators by design are reactive rather than anticipatory. As a result, traders must wait for confirmation, a process that introduces additional lag into the ability to take action. It is now widely accepted that classical oscillators can be very accurate in hindsight but are typically inadequate for forecasting future short-term market direction, in large part due to lag.

Probability Distribution Functions

The basic shortcoming of classical oscillators is that they are reactive rather than anticipatory. As a result, the undesirable lag component in oscillators significantly degrades their usefulness as a tool for profitable short-term trading. What is needed is an effective mechanism for anticipating turning points.

Figure 1. Theoretical Waveforms and their PDFs

Figure 1A. Square Wave

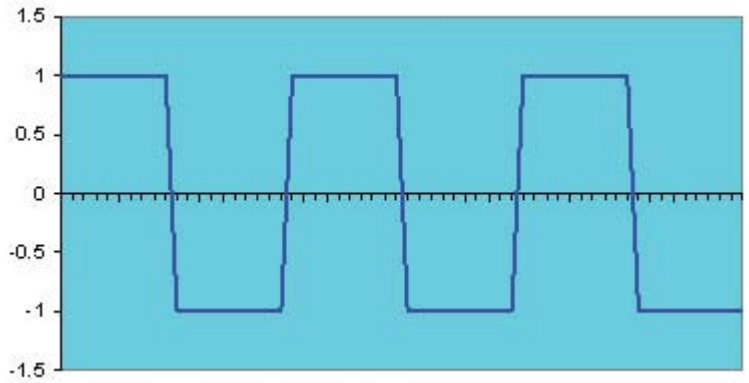


Figure 1B. Square Wave Binary PDF

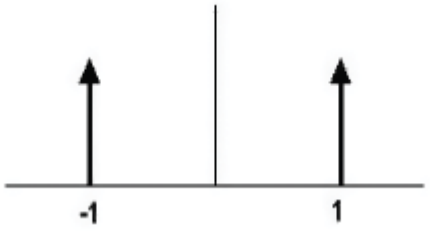


Figure 1C. Sine Wave

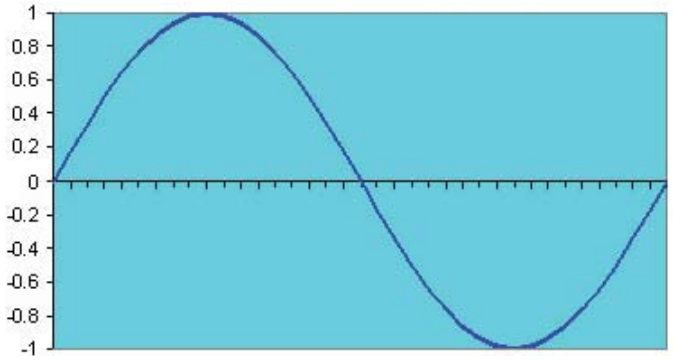


Figure 1D. Sinewave PDF

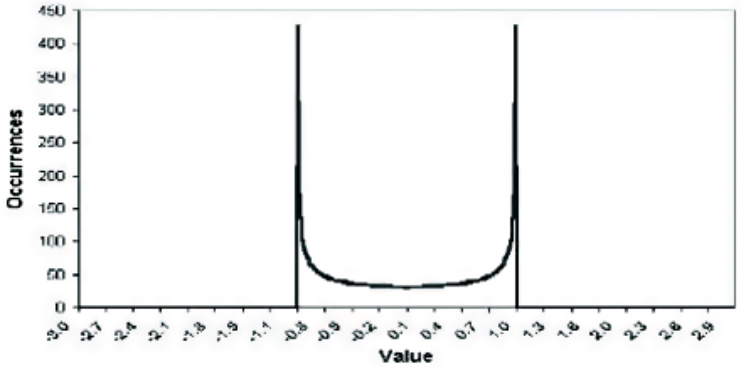


Figure 2. The Concept of Waveform and PDF Construction

Figure 2A. Sinewave Bead Waveform

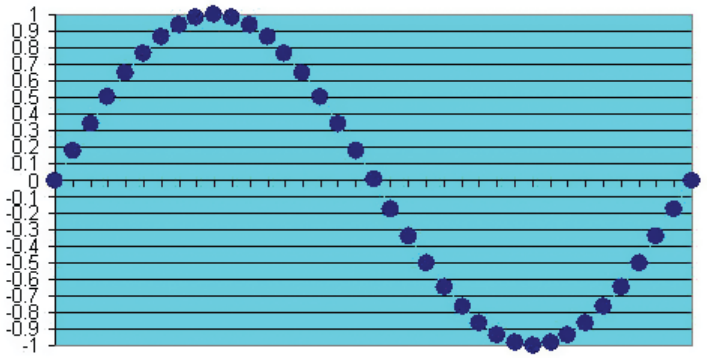
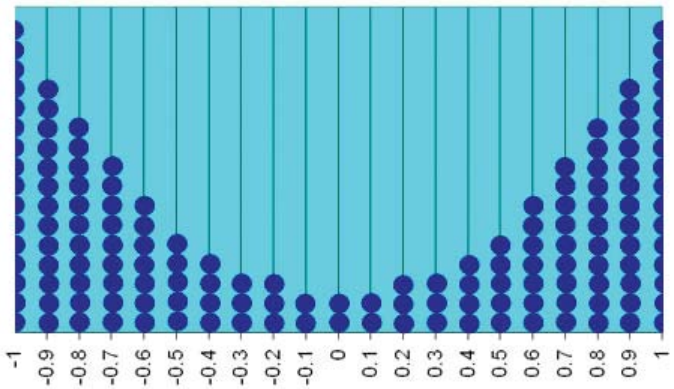


Figure 2B. Sinewave Bead PDF



The Probability Distribution Function (PDF) can be borrowed from the field of statistics and used to examine detrended market prices for the purpose of inferring trading strategies. The PDF offers an alternative approach to the classical oscillator; one that is non-causal in anticipating short-term turning points.

PDFs place events into "bins" with each bin containing the number of occurrences in the y-axis and the range of events in the x-axis. For example, consider the square wave shown in Figure 1A. Although unrealistic in the real world, if one were to envision the square wave as "quantum" prices that can only have values of -1 or +1, the resultant PDF consists simply of two vertical "spikes" at -1 and +1 as shown in Figure 1B. Such a waveform could not be traded using conventional oscillators, because any price movement would be over before the oscillator could yield a signal. However as Figures 1A and 1B will show, the theoretical square wave is not far removed from real-world short-term cycles.

As a practical example, a theoretical sine wave can be used to more accurately model real-world detrended prices. An idealized sinewave is shown in Figure 1C and its corresponding PDF in Figure 1D. The PDFs of the square wave and that of the sine wave are remarkably similar. In each case, there is a high probability of the waveforms being near their extremes, as can be seen in the large spikes in Figure 1D. These spikes correspond to short-term turning points in the detrended prices. The probability is high near the turning points, because there is very little price movement in these phases of the cycle, with prices ranging only from about 0.8 to 1.0 and -0.8 to -1.0 in Figure 1C.

The high probability of short-term prices being near their extreme excursions is a principal difficulty in short-term cycle and swing trading. The move has mostly occurred before the oscillators can identify the turning point. The indicator "works" but only in hindsight, limiting its usefulness for predicting future price movements.

A possible solution to this lag dilemma is to develop techniques to anticipate turning points. Although

Figure 3. Measured Channel PDFs of US Treasury Bonds Over 30 Years

Figure 3A. PDF of a 20 Bar Channel

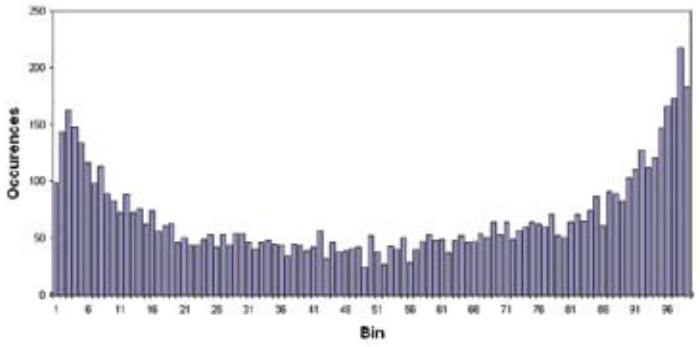


Figure 3B. PDF of a 40 Bar Channel

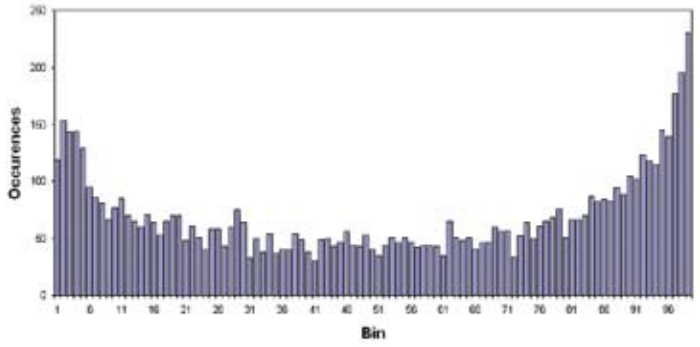
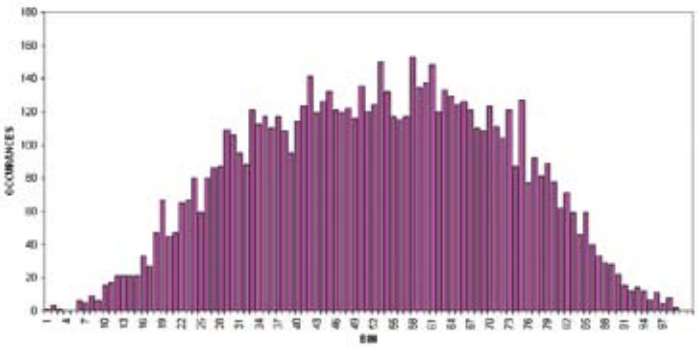


Figure 4. Measured RSI PDF of US Treasury Bonds Over 30 Years



exceedingly difficult to accomplish with classical oscillators, the PDF affords us the opportunity to anticipate turning points if properly shaped or to use two alternative methods:

1. Model the market data as a sine wave and shift the modelled waveform into the future by generating a leading cosine wave from it; and
2. Apply a transform to the detrended waveform to isolate the peak excursions, i.e. rare occurrences, and anticipate a short-term price reversion from the peak.

Each of these approaches will be examined below. However, it is instructive to begin with an analogy for visualising a theoretical sine wave PDF and then examine PDFs of actual market data. As will be shown, market data PDFs are neither Gaussian, as commonly assumed, nor random, as asserted by the Efficient Market Hypothesis.

Measuring Probability Distribution Functions

An easy way to visualize how a PDF is measured, as shown in Figure 2B on the preceding page, is to envision the waveform as beads strung on parallel horizontal wires on vertical frames as shown in Figure 2A. Rotate the wire-frame clockwise 90 degrees (1/4 turn) so the horisontal wires are now vertical, allowing the beads to fall to the bottom. The beads stack up in Figure 2B in direct proportion to their density at each horisontal wire in the waveform with the largest number of occurrences at the extreme turning points of +1 and -1.

Measuring PDFs of detrended prices using a computer program is conceptually identical to stacking the beads in the wire-frame structure. The amplitude of the detrended price waveform is quantised into "bins" (i.e. the vertical wires), and then the occurrences in each bin are summed to generate the measured PDF. The prices are normalised to fall between the highest point and the lowest point within the selected channel period.

Figure 3 shows actual price PDFs measured over thirty years using the continuous contract for US Treasury Bond Futures. Note that the distributions are similar to that of a sine wave in each case. The non-uniform shapes suggest that developing short-term trading systems based on sine wave modelling could be successful.

Normalising prices to their swings within a channel period is not the only way to detrend prices. An alternative method is to sum the up day closing prices independently from down days. That way the differential of these sums can be normalised to their sum. The result is a normalised channel, which is the generic form of the classic RSI indicator. The measured PDF, using this method of detrending of the same 30-years of US Treasury Bonds data, is shown in Figure 4. In this case, the PDF is more like the familiar bell-shaped curve of a Gaussian PDF. One could conclude from this that a short-term trading system based on cycles would be less than successful, as the high probability points are not near the maximum excursion turning points.

Because the turning points have

relatively low probability, an alternate strategy can be inferred. The idea is to buy when the detrended price crosses below a threshold near the lower boundary in anticipation of the prices reversing to higher probability territory. Similarly, the strategy would sell when the detrended price crosses above a threshold near the upper boundary. Note that this is not the same as using classical 30/70 or 20/80 thresholds for signals with the RSI, because the signal is not waiting for confirmation crossing back across the thresholds. Here, we are anticipating a reversal to a higher probability occurrence – we expect a reversion to normalcy. Using this anticipatory method in the case of a classic indicator, such as the Stochastic Oscillator, can be costly, because the Stochastic can easily remain at the extreme excursion point (or "rail" in engineering parlance) for long periods of time.

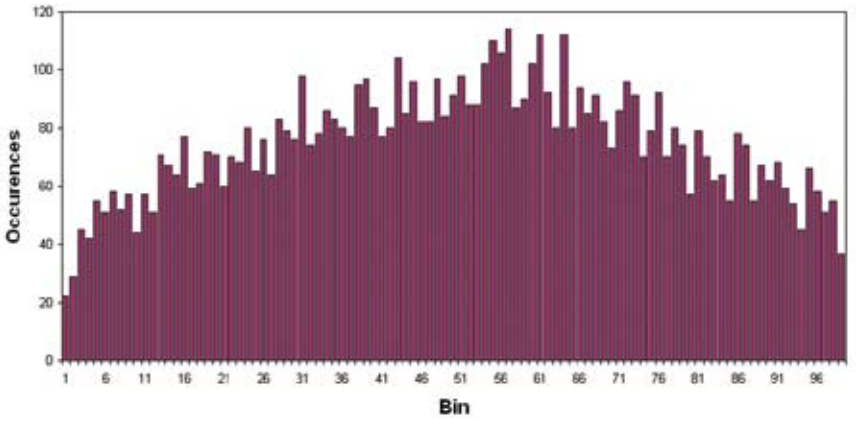
As previously mentioned, another way to detrend the price data is to filter it, to use high pass filter to remove its lower frequency trend components. Once detrended, the result must be normalised to a fixed excursion so that it can be properly binned before applying the PDF. The resulting PDF is shown in Figure 5. In this case, the PDF shape is nearly uniform across all bins. A uniform PDF means the amplitude in one bin is just as likely to occur as another. In this case, neither a cycles-based strategy nor a strategy based on low probability events could be expected to be successful. The PDF must somehow be transformed to enhance low probability events in order to be useful in trading.

Transforming the PDF

Not all detrending techniques yield PDFs that suggest a successful trading technique. In much the same way that an oscillator can be applied to price data to enhance short-term turning points, a transformation function can be applied to the detrended prices to enhance identification of "black swan," i.e. highly unlikely, events, and to develop successful trading strategies based on predicting a reversion back to normalcy following a black swan event.

For example, a PDF can be enhanced through the use of the Fisher Transform.

Figure 5. Measured HighPass Filter PDF of US Treasury Bonds Over 30 Years



This mathematical function alters input waveforms varying between the limits of -1 and +1, transforming almost any PDF into a waveform that is nearly Gaussian. The Fisher Transform equation, where x is the input and y is the output, is:

$$y = 0.5 * \mathrm{h}\left(\frac{1+x}{1-x}\right)$$

Unlike an oscillator, the Fisher Transform is a nonlinear function with no lag. The transform expands amplitudes of the input waveforms near the -1 and +1 excursions so they can be identified as low probability events.

As shown in Figure 6, the transform is nearly linear when not at the extremes. In simple terms, the Fisher Transform doesn't do anything except at the low-probability extremes. Thus, it can be surmised that if low probability events can be identified, trading strategies can be employed to anticipate a reversion to normal probability after their occurrence.

The effect of the Fisher Transform is demonstrated by applying it to the High Pass Filter approach that produced the PDF in Figure 5. The output is rescaled for proper binning to generate the new measured PDF. The new measured

Figure 6. The Fisher Transform Nonlinearly Converts Signal Amplitudes That Result in Nearly Normal PDFs

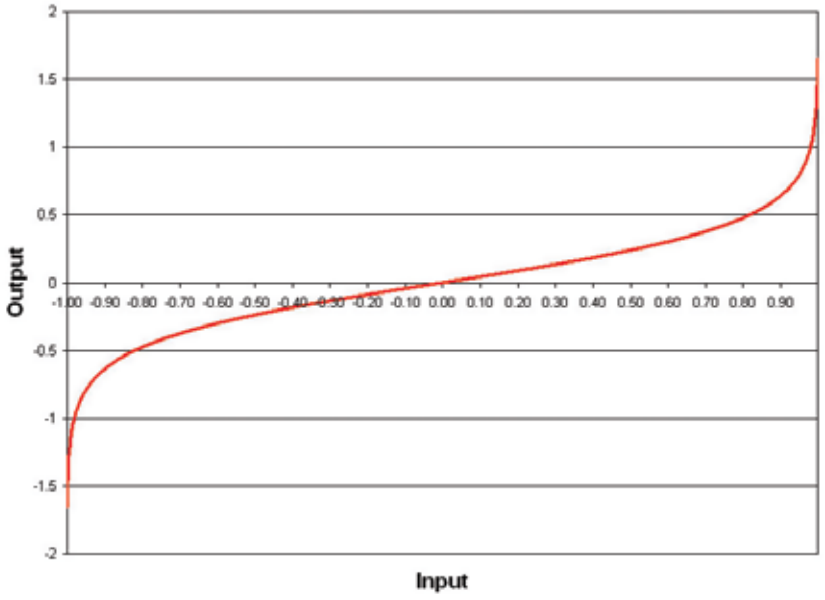
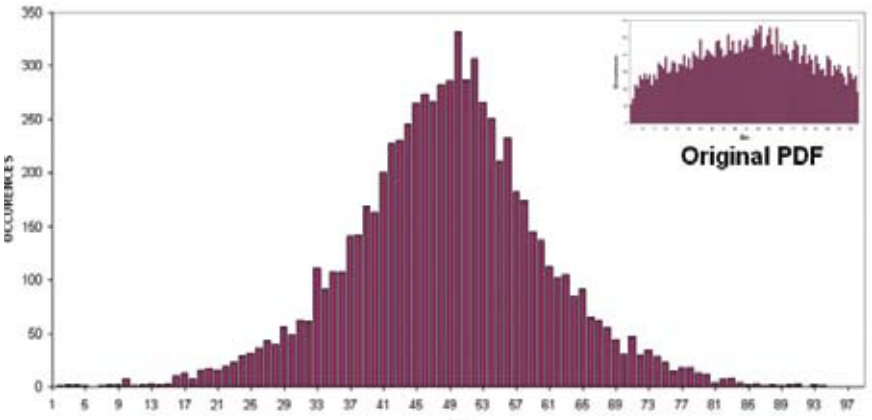


Figure 7. Measured HighPass Filter with Fisher Transform PDF of US Treasury Bonds Over 30 Years



PDF is displayed in Figure 7, with the original PDF shown in the inset for reference. Here we have a waveform that suggests a trading strategy using the low probability events. When the transformed prices exceed an upper threshold, the expectation is that staying beyond that threshold has a low probability. Therefore, exceeding the upper threshold presents a high probability selling opportunity. Conversely, when the transformed prices fall below a lower threshold, the expectation is that staying below that threshold is a low probability and, therefore, falling below the lower threshold presents a buying opportunity.

Derived Trading Strategies

It is clear that no single short-term trading strategy is suitable for all cases, because the PDFs can vary widely depending on the detrending approach. Since the PDF of data detrended by normalizing to peak values has the appearance of a theoretical sinewave, the logical trading strategy would be to assume the waveform is, in fact, a sine wave, and then identify the sine wave turning points before they occur. On the other hand, data that is detrended using a generic RSI approach or is detrended using a High Pass filter with a Hilbert Transform should use a trading strategy based on a more statistical approach. Thus, for the RSI and Hilbert Transform approaches, the logical strategy consists of buying when the detrended prices cross below a lower threshold, and selling when the detrended prices cross above an upper threshold. Although somewhat counterintuitive, this second strategy is based on the idea that prices outside the threshold excursions are low probability events, and the most likely consequence is that the prices will revert to the mean.

Both short-term trading strategies share a common problem. The problem is that the detrending removes the trend component, and the trend can continue rather than having the prices revert to the mean. In this case, a short-term reversal is exactly the wrong thing to do. Therefore, an additional trading rule is required. The rule added to the strategies is to recognize when the prices have moved opposite to the short-term position by a percentage of the entry price. If that occurs, the position is simply reversed, and the new trade is allowed to go in the direction of the trend.

The "Channel" Cycle Strategy finds the highest close and the lowest close over the channel length, which are computed by a simple search algorithm over a fixed lookback period. Then, the detrended price is computed as the difference between the current close and the lowest close, normalised to the channel width. The channel width is the difference between the highest close and the lowest close over the channel length. The detrended price is then BandPass filtered to obtain a near sine wave from the data whose period is the channel length. From the calculus, it is known that $d(\text{Sin}(\omega t))/dt = \omega\text{Cos}(\omega t)$. Since a simple one bar difference is a rate-change, it is roughly equivalent to a derivative. Thus, an amplitude corrected leading function is computed as the one bar rate of change divided by the known angular frequency. In this case, the angular frequency is 2π divided by the channel length. Having the sine wave and the leading cosine wave, the major trading signals are the crossings of these two waveforms. The strategy also includes a reversal if the trade has an adverse excursion in excess of a selected percentage of the entry price.

The Generic "RSI" Strategy sums the differences in closes up independently from the closes down over the selected RSI length. The RSI is computed as the differences of these two sums, normalised to their sum. A small amount of smoothing is introduced by a three tap FIR filter. The main trading rules are to sell short if the Smoothed Signal crosses above the upper threshold, and to buy if the Smoothed Signal crosses below the lower threshold. As before, the strategy also includes a reversal if the trade has an adverse excursion in excess of a selected percentage of the entry price.

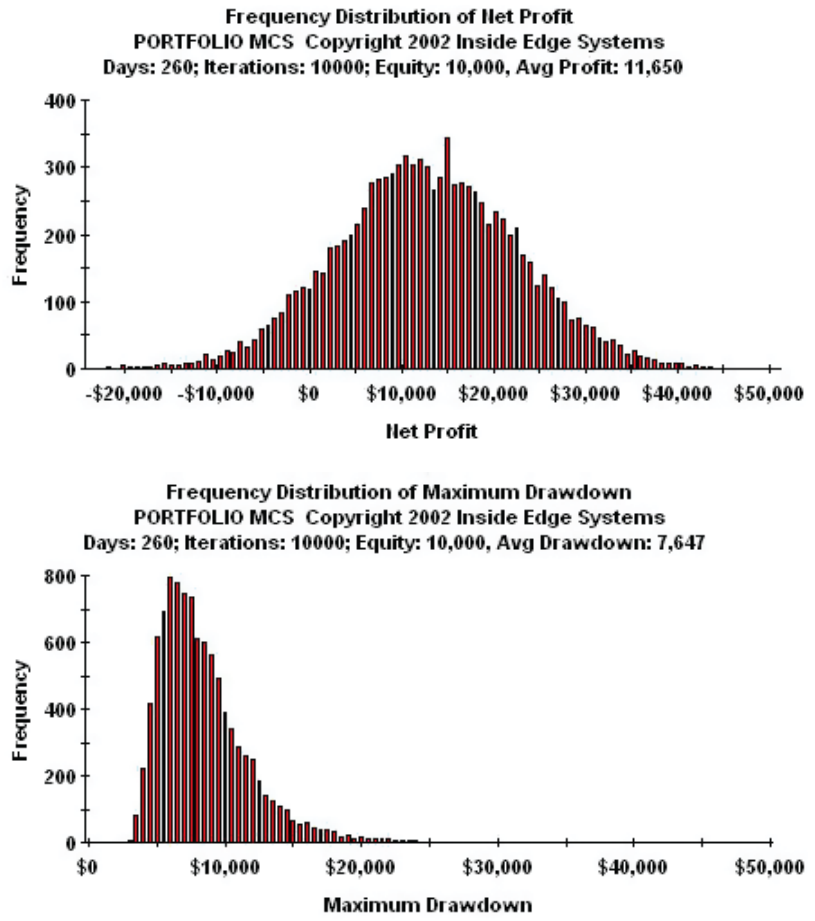
The High Pass Filter plus Fisher Transform ("Fisher") strategy filters the closing prices in a high pass filter [i]. The filtered signal is then normalised to fall between -1 and +1, because this range is required for the Fisher Transform to be effective. The normalised amplitude is smoothed in a three tap FIR filter. This smoothed signal is limited to be greater than -.999 and less than +.999 to avoid having the Fisher Transform blow up if its input is exactly 1. Finally, the Fisher Transform is computed. The main trading rules are to sell short if the Fisher Transform crosses above the upper threshold, and to buy if the Fisher

Transform crosses below the lower threshold. As before, the strategy also includes a reversal if the trade has an adverse excursion in excess of a selected percentage of the entry price.

The three trading strategies were applied to the continuous contract of US Treasury Bond Futures for data five years prior to 12/7/07. The performance of the three systems is summarised in Table 1. All three systems show respectable performance, with the RSI strategy and Fisher strategy having similar performance, with respect to percentage of profitable trades and profit factor (gross winnings divided by gross losses). All results are based on trading a single contract with no allowance for slippage and commission. It is emphasized that all settings were held constant over the entire five-year period. Since the trading strategies have only a small number of optimisable parameters, optimising over a shorter period is possible without compromising a trade-to-parameter ratio requisite to avoid curve fitting. Thus, performance can be enhanced by optimising over a shorter time span.

Annualised performance of the trading strategies was assessed by applying the real trades over the five-year period to a Monte Carlo analysis for 260 days, an approximate trading year. In each case the Monte Carlo analysis used 10,000 iterations, simulating nearly 40 years of trading. Software to do this analysis was MCSPro [ii] by Inside Edge Systems. Due to the central limit theorem, the probability distribution of annual profit has a Normal Distribution and the Drawdown has a Rayleigh Distribution. The Monte Carlo analysis has the advantages that not only are the most likely annual profits and drawdowns produced, but also one can easily assess the probability of breakeven or better. Further, one can make a comparative reward/risk ratio by dividing the most likely annual profit by the most likely annual drawdown. One can also evaluate the amount of tolerable risk and required capitalisation in small accounts from the size of the two or three sigma points in the drawdown.

Figure 8. Annualised Performance Monte Carlo Results for Channel Strategy



The Monte Carlo results for the Channel strategy are shown in Figure 8. The most likely annual profit is $11,650, and the most likely maximum drawdown is $7,647, for a reward to risk ratio of 1.52. The Channel strategy has an 88.3% chance of break even or better on an annualised basis.

Table 1. Trading Strategy Performance Comparison

Trading Strategy	Channel	RSI	Fisher Transform
Net Profit	$54,968	$72,468	$73,125
# Trades	142	119	135
% Profitable	53.5	57.1	57.0
Profit Factor	1.72	2.05	2.10
Drawdown	($15,520)	($11,625)	($9,125)

Figure 9. Annualized Performance Monte Carlo Results for RSI Strategy

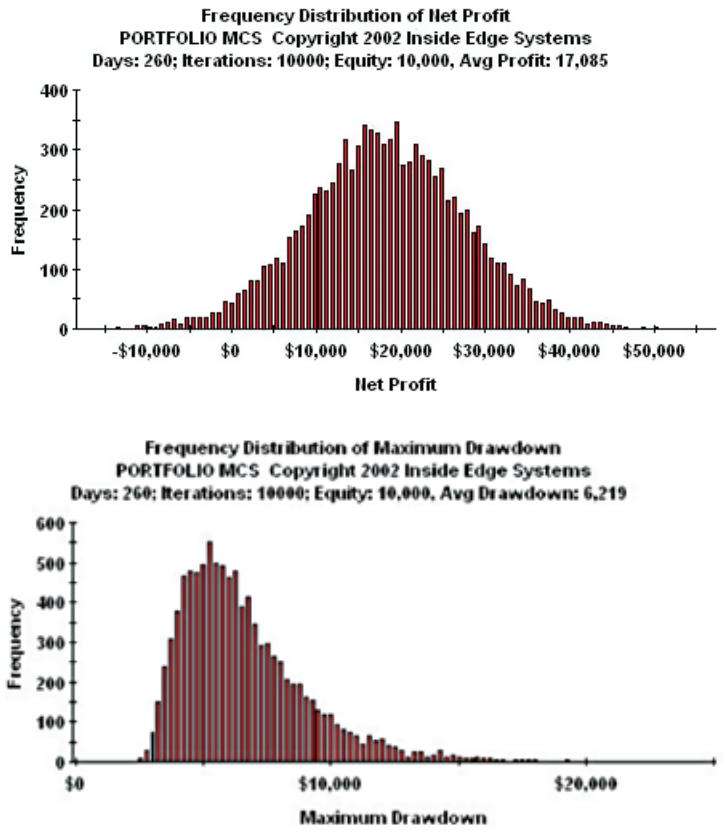
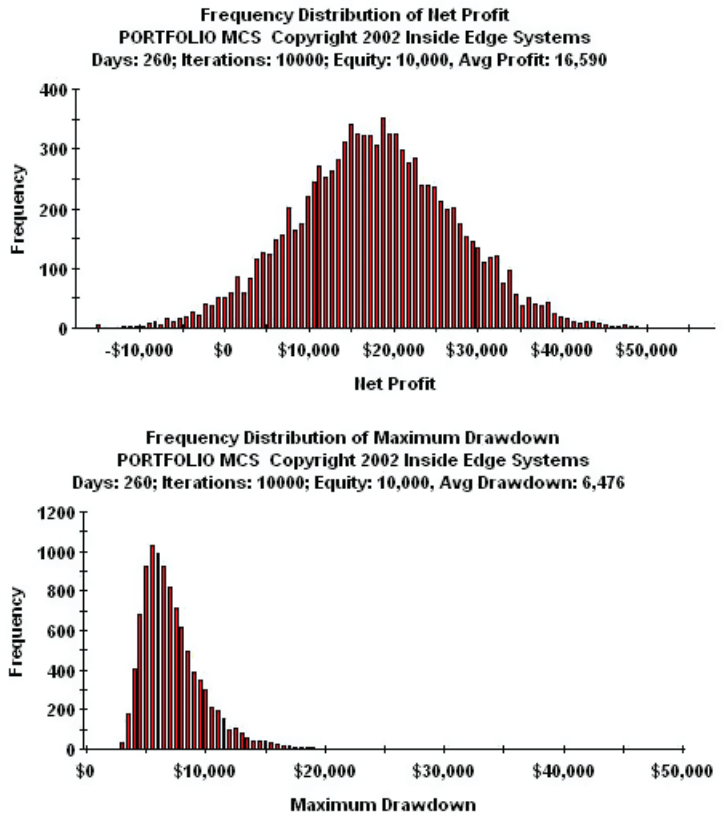


Figure 10. Annualized Performance Monte Carlo Results for Fisher Strategy



The Monte Carlo results for the RSI strategy are shown in Figure 9. The most likely annual profit is $17,085 and the most likely maximum drawdown is $6,219. Since the profit is higher and the drawdown is lower than for the Channel strategy, the reward to risk ratio is much larger at 2.75. The RSI strategy also has a better 96.6% chance of break even or better on an annualised basis.

The Monte Carlo results for the Fisher strategy are shown in Figure 10. The most likely annual profit is $16,590, and the most likely maximum drawdown is $6,476. The reward to risk ratio of 2.56 is about the same as for the RSI strategy. The Fisher Transform strategy also has about the same chance of break even or better at 96.1%.

These studies show that the three trading strategies are robust across time and offer comparable performance when applied to a common symbol. To further demonstrate robustness across time, as well as applying to a completely different symbol, performance was evaluated on the S&P Futures, using the continuous contract from its inception in 1982. In this case, we show the equity curve produced by trading a single contract without compounding. There is no allowance for slippage and commission. The shape of the equity curves is explained, in part, by the change of the point size from $500 per point to $250 per point, by inflation, by the increasing absolute value of the contract, and by increased volatility. The major point is that none of the three trading strategies had significant dropouts in equity growth over the entire lifetime of the contract.

The robust performance of these new trading strategies is particularly striking when compared to more conventional trading strategies. For example, Figure 14 on the following page shows the equity growth of a conventional RSI trading system that buys when the RSI crosses over the 20% level and sells when the RSI crosses below the 80 % level. This system also reverses position when the trade has an adverse excursion more than a few percent from the entry price. This conventional RSI system was optimised for maximum profit over the life of the S&P Futures Contract. Not only

has the conventional RSI strategy had huge drawdowns, but its overall profit factor was only 1.05. Any one of the new strategies I have described offers significantly superior performance over the contract lifetime. This difference demonstrates the efficacy of the approach and the robustness of these new systems.

Conclusions

The PDF has been shown to offer an alternative approach to the classical oscillator, one that is non-causal in anticipating short-term turning points.

Several specific trading strategies have been presented that demonstrate robust performance across long timespans to accommodate varying market conditions; across a large number of trades to avoid curve fitting; and among different markets to demonstrate freedom from market personalities.

In each case the PDF can infer a trading strategy that is likely to be successful. When no strategy is suggested, the Fisher Transform can be applied to change the PDF to a Gaussian distribution. The Gaussian PDF then infers that a trading strategy using a reversion to the mean can be successful. IFTA

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i J. Ehlers, Swiss Army Knife Indicator, *Stocks & Commodities Magazine*, 42(1): Jan. 2006: p. 28-31, 50-53.

ii MCSPro, Inside Edge Systems.

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EHLERS, J. Swiss Arms Knife Indicator. *Stocks & Commodities Magazine,* 42(1): Jan. 2006.

Software

MCSPro, Inside Edge Systems, Bill Brower, 200 Broad Street, Stamford, CT 06901.

Figure 11. 25 Year Equity Growth of Channel Strategy Trading the SP Futures Contract

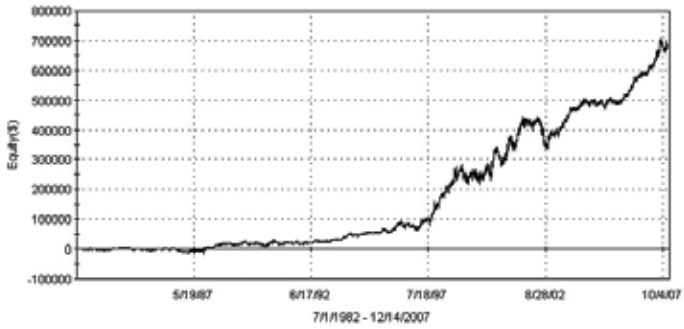
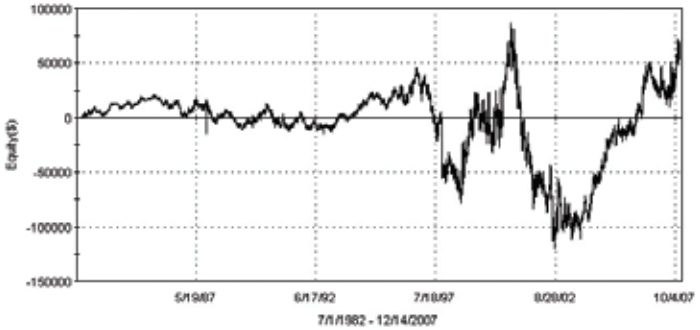


Figure 12. 25 Year Equity Growth of RSI Strategy Trading the SP Futures Contract

Figure 13. 25 Year Equity Growth of Fisher Strategy Trading the SP Futures Contract

Figure 14. 25 Year Equity Growth of a Conventional RSI StrategyTrading the SP Futures Contract



Volume Zone Oscillator (VZO)

by Waleed Aly Khalil

Abstract

Most, if not all, volume indicators depend on divergence, which in itself is not a signal. The trader has to wait for a confirmation from the price action before executing a trade, for example Joe Granville's On Balance Volume (OBV) indicator, which is calculated by adding the day's volume to a running cumulative total when the security's price closes up and subtracts the volume when it closes down. The main idea of the VZO was to try to change the OBV to look like an oscillator rather than an indicator, also to include time; primarily to identify which zone the volume is located in during a specific period, in the bulls' zone or the bears' zone, to decide which side we should ride on. The VZO uses the same OBV negative/positive volume separation rule to separate bulls' volume from bears' volume, but instead of running a cumulative total, the VZO smoothes these ± volumes by an Exponential Moving Average (EMA) for a given period, and then divides it with a smoothed EMA of the total volume for the same period. The VZO is a leading volume oscillator; its basic usefulness is in giving leading buy/sell signals based on volume conditions, also to identify overbought/oversold volume conditions, along with mega overbought/oversold situations which lead to a change in sentiment, and most probably, leads to change of the current trend in the timeframe being studied.

Part One: Introduction

Volume is simply the number of shares or contracts that have been traded throughout the day; the higher the volume, the more active the security.

1.1 Why is Volume Important?

Volume is always treated as a secondary indicator, despite its great importance in confirming trends and chart patterns. Any price movement, whether up or down, with relatively high volume is categorised as stronger than a similar move with low volume.

Traders must always look at price patterns in conjunction with their associated volume patterns. For example, a stock may appear to be in a head and shoulders or in a flag formation, but the associated volume must confirm that analysis.

Volume should move with the trend. If prices are moving in an uptrend, volume should increase with rising prices. The opposite should occur in a downtrend; volume should increase with falling prices. If the previous relationship between volume and price movements starts to change, it is usually a sign of weakness in the trend.

Well above normal volume is essential when separating a true from a false breakout above resistance or below support.

Price is preceded by volume; that's another important idea in technical analysis. If volume starts to decrease in an uptrend, it is usually a sign that shows that the upward run is about to end.

From all of the above, we believe that volume should have the same importance as price and should be monitored closely.

1.2 Volume Zone Oscillator (VZO)

Volume Precedes Price is the conceptual idea for the oscillator.

Waves of buying and selling originate as a result of the battle between bullish and bearish activity and is the idea behind separating the bulls from the bears, i.e. to identify the direction of the next move, depending on volume.

Volume's leading characteristic is the basic premise of this oscillator. Unlike the rest of volume oscillators, which depend on divergence (which in itself is not a signal), the trader has to wait for a confirmation from the price action before executing a trade.

This oscillator's basic usefulness is in giving leading buy/sell signals, identifying overbought/oversold volume conditions, along with mega overbought/oversold situations which lead to a change in sentiment and most probably lead to a change of the current trend in the timeframe being studied.

One of the main benefits of the VZO is primarily being able to identify in which zone the volume is positioned, to decide which side we should ride on.

Part Two: The Calculation

The formula depends on only one condition; if the close of today is higher than the close of yesterday, the volume will be considered bullish, otherwise it will be bearish.

Volume zone oscillator =
$100 \times (VP \div TV \frac{VP}{TV})$

Where, VP (Volume Position) =
X-days EMA (± volume).

And, TV (Total volume) =
X-days EMA (volume).

2.1 Formula in depth:

Below is an explanation of the formula and the code as written in AmiBroker software, using sample data containing only the close price and the volume.

- First, a variable is used to daily store an up volume or a down volume.
R= IIf (C> Ref(C,-1), V,-V);

- For smoothing, VP equals exponential moving average of R for a given period.
VP= EMA (R, period);
- TV equals the exponential moving

Data Sample:

Date	Close	Volume	R
1/1/2008	20	800	-
2/1/2008	20.5	1000	1000
3/1/2008	20	700	-700
4/1/2008	21	900	900
5/1/2008	22	1100	1100
6/1/2008	21.5	500	-500
9/1/2008	22.5	1200	1200
10/1/2008	23	800	800

average of the total volume for the same period.
TV=EMA (V, period);

- Finally the VZO equals VP divided by TV, multiplied by 100 to make the vertical scale oscillate between -100 to 100.

VZO=100 X (VP/TV);

- The table above shows a data sample for 8 days. If we choose a 6-day period, on the last day, we will have the following values:

VP =EMA(R,6) will =585.71
TV= EMA(V,6) will = 898.64
VZO = 100 X(585.71/898.64) = 65.18

- From the example above, we can see that if the cumulative R has a positive value, the oscillator will move up, while if it has negative value, the oscillator will move down.

Part Three: VZO Trading Tactics

3.1 Overall Appearance:

- VZO is located below the price action; it fluctuates between positive and negative 100.
- Near -100, the bears are dominating, while near +100, the bulls are dominating.
- For every seller, there is a buyer and vice versa; it is a zero sum game, so actually the 100 and the -100 levels rarely exist.
- The oscillators' upper and lower boundaries (overbought/oversold) are positive and negative 40.
- The 60/-60 level actually marks extreme optimism or pessimism.
- The zero line demonstrates equilibrium between bulls and bears.
- The VZO tends to fluctuate between -40 and +40, the crossing of each creates buy/sell signals. The default period for the VZO is 14. However, the period can be adjusted for sensitivity or for a preferred timeframe.
- The interpretations of the Positive and Negative 60 depend on the current trend; moving further below -60 in an uptrend is powerfully bearish, which indicates a change in sentiment. Moreover, bouncing from that level most probably won't reach the upper boundary and will retrace from the zero level. Vice versa with +60 in a downtrend, moving further above +60 in a downtrend is powerfully bullish, indicating a change in sentiment. Moreover, retracing from that level most probably won't reach the lower boundary and will bounce from the zero level.
- In an uptrend, the oscillator tends to fluctuate between the zero and +40 because the bulls are powerful and dominating; vice versa with a downtrend, the VZO tends to fluctuate between -40 and the zero.

3.2 Trading Tactic 1

When the oscillator reaches the zone between -40 and -60, it means that the bears have already offloaded their shares, and this increases the likelihood of the bulls stepping in; just the opposite is true with the zone between +40 and +60.

The basic rule for a buy/sell signal is that crossing the -40 from below gives a buy signal, while crossing the +40 from above gives a sell signal.

From Figure 2, a buy signal is triggered when the VZO crosses below negative 40 and then crosses back up, while a sell signal is triggered when the

Figure 1- The main interface of the VZO

Figure 2- Template demonstrates simple buy/sell signal.

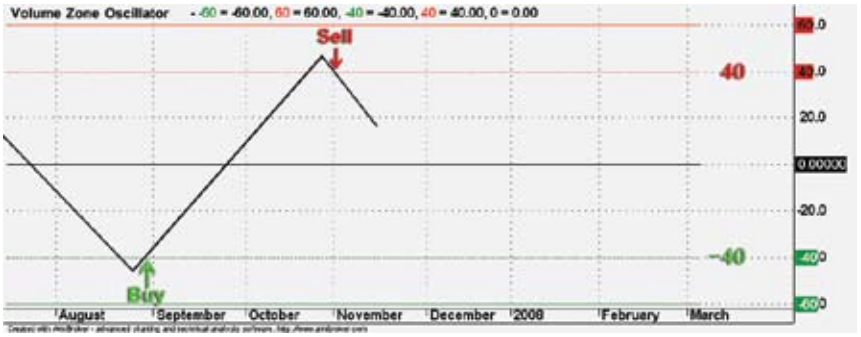


Figure 3- Dow Jones Industrial index (DJI) "($INDU) "

Figure 4- Ezz Steel (ESRS.CA) Daily chart "Cairo Stock Exchange"

Figure 5- Egyptian telecom (ETEL.CA) Daily chart "Cairo Stock Exchange"

Figure 6- Misr Aluminum (EGAL.CA) Daily chart "Cairo Stock Exchange"

VZO crosses above the 40 level and then crosses back down.

This tactic is considered to be ideal for sideways trends; during those periods, the VZO will tend to fluctuate between -40 and 40.

Figures 3 –6 are some examples from different markets that apply this tactic.

3.3 Trading Tactic 2

Retracing from positive 40 and failure to reach the lower boundary means that bulls have entered early, which indicates strength, and crossing the zero level generates a buy signal.

From Figure 7, in a bullish period, the VZO tends to rebound before reaching the lower boundary. This indicates strength in the market.

This is the ideal case for an uptrend; the VZO will not reach the lower boundary and will rebound from a zone above the -40 level.

Figure 8 demonstrates an ideal VZO movement during an uptrend in which the VZO has a tendency to stay in the upper zone, fluctuating between the zero and the 40 level.

Figure 7- Template demonstrates ideal buy/sell signal during uptrend.

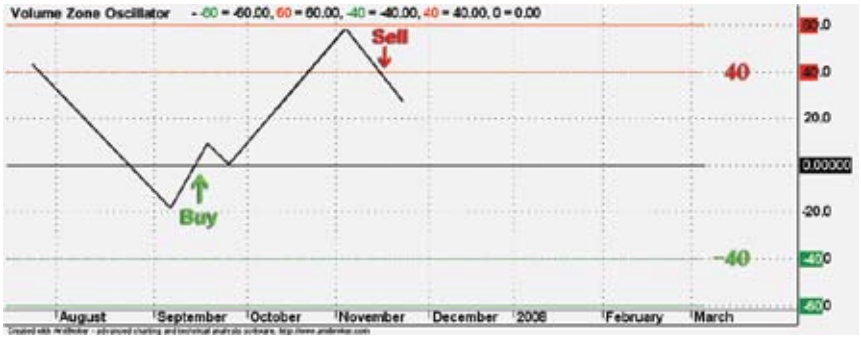


Figure 8- Case30.CA The index of Cairo Stock Market.

Figure 9 - Template demonstrates Re-entry signal.

Figure 10 - Upper Egypt Flour Mills (UEFM.CA) Daily chart "Cairo Stock Exchange"

Figure 11- Mokhtar Ibrahim Construction (ECMI.CA) Daily chart "Cairo Stock Exchange"

3.3.1 Re-Entry

When the VZO crosses down through the +40 giving a sell signal, but it did not retrace further than the zero line, the VZO bounces back up towards the upper boundary. This is considered as strength, and a re-entry point when the VZO re-crosses +40 from below.

To avoid whipsaws, filters can be used. That's to say, buying on the break of 45 or 50 instead of 40. By using filters, it ensures that the move is powerful enough and increases the possibilities for profit.

3.4 Trading Tactic 3

Rebounding from negative 40 and failure to reach the upper boundary means that the bears have entered early, which indicates weakness, and crossing the zero level from above generates a sell signal.

From Figure 12, during a bears' period and due to their power, the VZO tends to retrace before reaching the upper boundary, indicating weakness in the market.

Figure 13 demonstrates an ideal VZO movement in a downtrend in which the VZO has a tendency to stay in the lower zone, fluctuating between the -40 and the zero level.

3.4.1 Exit Signal:

When the VZO crosses above the -40 giving a buy signal, then retraces toward the lower boundary before touching the zero line, it is considered a sign of weakness, and the trade should be exited once the VZO crosses down below -40 level.

To reduce whipsaws, it is better to use filters in a downtrend by crossing down -50, and in an uptrend by crossing down -45.

Figure 12- Template demonstrates ideal buy/sell signal during downtrend.

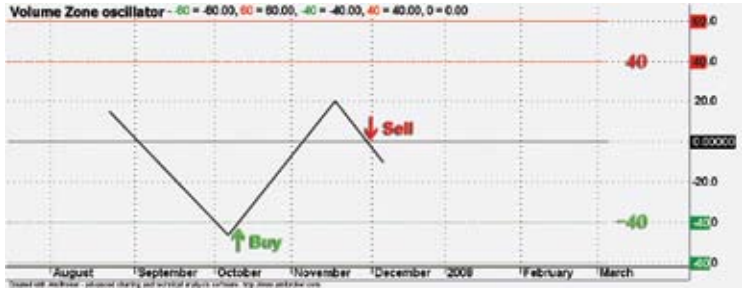


Figure 13- HRHO.CA "Cairo Stock Market."

Figure 14 - Template demonstrates Exit signal.

Figure 15 - Bed Bath & Beyond Inc (BBBY) NASDAQ Exchange

Figure 16- Hermes Holding (HRHO) Daily chart "Cairo Stock Exchange

Figure 17- General Motors (GM) weekly chart "NYSE Exchange"

3.5 Trading Examples

Ideal cases don't exist all the time, so all the tactics need to be used. With this in mind, trading in the upper zone between the zero and the 40 level is a sign of strength, while trading in the lower zone between the -40 and zero level is a sign of weakness.

In Figure 16, during November/ December, the VZO did not retrace down to negative 40 but rather reversed up. Up until that point, the move would be considered a sign of strength, but the buy doesn't confirm until the VZO crosses above the zero line. In January/ February, the VZO gave a buy signal crossing up the negative 40 level, the VZO did not reach the upper boundary (40 level), but rather retraced down. This is a sign of weakness, but the sell doesn't confirm until the VZO crosses below the zero line.

In Figure 17, during March/April, the VZO did not retrace to -40, but rather fluctuated around the zero line with poor signals (whipsaws) before continuing to the lower boundary, at which point a strong buy signal occurs from the crossing above the -40 level.

- Sometimes and as a limitation, when the VZO reaches the zero level, which is considered as an equilibrium level between bulls and bears, it fluctuates around it before making a move in whipsaw action. When this occurs, the strategy should be to exit and wait for the VZO to reach either the upper or the lower boundary to confirm either a buy or sell signal.
- To enhance the system and to reduce whipsaws, we can use filters, for example, buy when crossing 20 instead of zero.

Part Four: Important Interpretations

The VZO does not only give buy/sell signals. It can also be used to identify hidden strength or weakness in the market, by using divergences, swings, support and resistance analysis.

4.1 Divergences:

Divergence analysis is very important, as it shows hidden weakness or strength in the market, which is not apparent in the price action.

Positive divergence occurs when the VZO rises up while the price is still declining, which indicates a hidden strength in the market.

Negative divergence occurs when the price moves to a new or same high while the VZO makes a lower high than its previous one, which indicates hidden weakness in the market.

As seen in Figure 18, during October, a negative divergence took place, as the price reached the same high while the VZO was declining. Then a weakness was seen in the VZO, as it stayed in the lower zone from November to January. On the other hand, during January, a positive divergence took place, as the price made a new low while the VZO was rising. Then, strength was seen in the VZO, as it stayed most of the time in the upper zone.

4.2 VZO support & resistance:

Support and Resistance analysis can be applied to the VZO. The VZO can reach a support level, which it can bounce from up towards the 40 level, or vice versa, it can obtain a resistance level, where it can retrace down towards the -40 level.

In Figure 19, the VZO formed a support level from which it rebounds towards the 40 level, with the prices following the action.

In Figure 20, the VZO formed a resistance level from which it retraces down towards the -40 level, with the prices following the action.

Figure 18 - Electronic Arts Inc (ERTS) "NASDAQ Exchange"

Figure 19 - Nile Cotton (NCGC.CA) Daily chart "Cairo Stock Exchange"

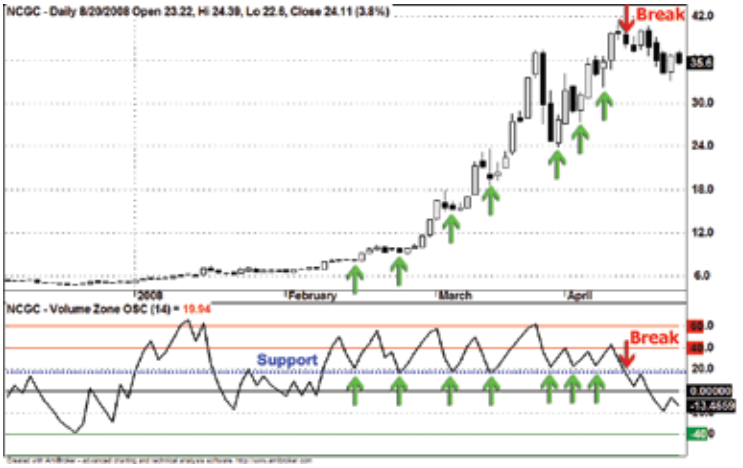


Figure 20 - Media Production City (MPRC.CA) Daily chart "Cairo Stock Exchange"

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- Have financial certification such as CFA, CPA, MBA, PLUS five years experience as a technician
- Have experience only (eight years minimum)

4.3 Extreme Values:

When the VZO reaches extreme values (over 60 / under -60), this indicates extreme market conditions (optimism/ pessimism). Reaching extreme levels means that the bulls/ bears have reached their maximum power and should take a break, and that a change in trend is likely.

If the extreme value happens after a long sharp trend and is followed by another extreme to the other side (swing), then the odds are in favour of reversal.

Figures 21, 22, and 23 highlight the VZO at extreme values above 60 or below -60 with the price changing its direction.

Figure 21 - Caterpillar Inc. (CAT) "http://moneycentral.msn.com/companyreport?symbol=BBBY New York Stock Exchange (NYSE) "

Figure 22 - ADC Telecommunications (NASDAQ)

Figure 23- General Motors (GM) DAILY chart "NYSE Exchange"

Table 1- back testing results, for using (tactic 1) for 5 years in Egypt Stock Market

Egypt Stock Exchange	01/01/2003 to 01/01/2008		Tactic 1 Statistics
All trades 122	**Net Profit %** 4982.51%	**Avg. Profit/Loss %** 4.95%	**Avg. Bars Held** 10.07
Winners	73 (59.84 %)	**Losers**	49 (40.16 %)
Avg. Profit %	10.55%	**Avg. Loss %**	-3.40%
Avg. Bars Held	10.66	**Avg. Bars Held**	9.18
Largest win	99668.34	**Largest loss**	-44150.55
# bars in largest win	30	**# bars in largest loss**	6
Net Profit %	4982.51%	**Max. trade % drawdown**	-23.84%
Exposure %	71.47%	**Profit Factor**	2.99
Net Risk Adjusted Return %	6971.56%	**Payoff Ratio**	2.01
Annual Return %	119.48%	**Risk-Reward Ratio**	1.46
Risk Adjusted Return %	167.18%	**Sharpe Ratio of trades**	1.61

Table 2- back testing results, for using (tactic 1) for 5 years in New York Stock Exchange

New York Stock Exchange	01/01/2003 to 01/01/2008		Tactic 1 Statistics
All trades	**Net Profit %**	**Avg. Profit/Loss %**	**Avg. Bars Held**
169	611.94%	1.34%	8.54
Winners	89 (52.66 %)	**Losers**	80 (47.34 %)
Avg. Profit %	4.82%	**Avg. Loss %**	-2.53%
Avg. Bars Held	9.08	**Avg. Bars Held**	7.95
Largest win	11708.39	**Largest loss**	-2587.76
# bars in largest win	13	**# bars in largest loss**	6
Net Profit %	611.94%	**Max. trade % drawdown**	-12.84%
Exposure %	97.22%	**Profit Factor**	2.12
Net Risk Adjusted Return %	629.47%	**Payoff Ratio**	1.91
Annual Return %	48.05%	**Risk-Reward Ratio**	1.72
Risk Adjusted Return %	49.42%	**Sharpe Ratio of trades**	1.32

Part Five: Testing the VZO

5.1 Testing Tactic 1

The sideways trend denotes market conditions in which prices may be moving back and forth between levels of support and resistance and is the ideal situation for this tactic. The VZO should fluctuate between -40 and 40. This means that the bulls' power is equal to the bears' power, giving a buy signal crossing up -40 and a sell signal crossing down below the 40 level.

During sideways periods, there can be times when the bulls or bears show some extra strength, and as a result, the VZO may move during this strength period either in the upper zone between 0 and 40 or in the lower zone between -40 and 0. That means more buy and sell signals, keeping in mind the whipsaws mentioned earlier.

To reduce the risk and to reduce whipsaws, the buy signal was triggered by crossing above the 15 level instead of the zero as a confirmation of the bullish power. While a sell signal was triggered by crossing beneath the -5 level to reduce the risk.

To define sideways in the system, stocks with their ADX () below 18 were considered to be moving sideways.

As this oscillator depends on volume, the test was limited to stocks with their 15-day average volumes above 25000 shares.

5.2 Testing Tactic 2

During uptrends, the bulls are in control, so it is unlikely that the VZO would reach maximum bearish power zone (-40). This means that the VZO will rebound from a zone above the -40 (failure to reach the lower boundary); accordingly a buy signal registers crossing above zero, and a sell signal crossing down below the 40 level.

As previously mentioned, volume must confirm any up move and should increase with rising prices, while in the down move, prices can fall by their own weight. So to reduce whipsaws, and also to confirm the up moves, the buy signal was triggered by crossing above the 20 level instead of the zero as a confirmation of the bullish power.

Reaching the oversold level in an uptrend means a great buying opportunity, which means adding one more buying signal by crossing the -40 from below. So, we have two buying signals, one crossing above the -40 and the other crossing above the 20 level, and only one sell signal on crossing below the 40 level.

If the VZO went below -45 in an uptrend, it would mean that bears had gained in power, and an exit signal would be triggered.

To define the uptrend in the system, stocks above their 60-day EMA () were considered in uptrend.

As this oscillator depends on volume, the test was limited to stocks with their 15-day average volumes above 25000 shares.

Table 3- back testing results, for using (tactic 2) for 5 years in Egypt Stock Market

Egypt Stock Exchange	01/01/2003 to 01/01/2008		Tactic 2 Statistics
All trades	**Net Profit %**	**Avg. Profit/Loss %**	**Avg. Bars Held**
92	2582.11%	3.96%	13.82
Winners	59 (64.13 %)	**Losers**	33 (35.87 %)
Avg. Profit %	8.99%	**Avg. Loss %**	-5.05%
Avg. Bars Held	14.24	**Avg. Bars Held**	13.06
Largest win	49990.17	**Largest loss**	-25106.6
# bars in largest win	24	**# bars in largest loss**	10
Net Profit %	2582.11%	**Max. trade % drawdown**	-27.56%
Exposure %	85.18%	**Profit Factor**	4.09
Net Risk Adjusted Return %	3031.18%	**Payoff Ratio**	2.29
Annual Return %	93.13%	**Risk-Reward Ratio**	1.26
Risk Adjusted Return %	109.33%	**Sharpe Ratio of trades**	1.34

Table 4- back testing results, for using (tactic 2) for 5 years in New York Stock Exchange

New York Stock Exchange	01/01/2003 to 01/01/2008		Tactic 2 Statistics
All trades	**Net Profit %**	**Avg. Profit/Loss %**	**Avg. Bars Held**
81	477.49%	2.58%	17.02
Winners	49 (60.49 %)	**Losers**	32 (39.51 %)
Avg. Profit %	7.68%	**Avg. Loss %**	-5.22%
Avg. Bars Held	16.2	**Avg. Bars Held**	18.28
Largest win	16878.01	**Largest loss**	-6236.78
# bars in largest win	29	**# bars in largest loss**	25
Net Profit %	477.49%	**Max. trade % drawdown**	-20.35%
Exposure %	97.13%	**Profit Factor**	1.86
Net Risk Adjusted Return %	491.61%	**Payoff Ratio**	1.21
Annual Return %	41.98%	**Risk-Reward Ratio**	1.33
Risk Adjusted Return %	43.22%	**Sharpe Ratio of trades**	0.82

Table 5- back testing results, for using (tactic 3) for 5 years in Egypt Stock Market

Egypt Stock Exchange	01/01/2003 to 01/01/2008		Tactic 3 Statistics
All trades	**Net Profit %**	**Avg. Profit/Loss %**	**Avg. Bars Held**
87	953.48%	3.90%	12.55
Winners	52 (59.77 %)	**Losers**	32 (39.51 %)
Avg. Profit %	9.81%	**Avg. Loss %**	-5.22%
Avg. Bars Held	14.62	**Avg. Bars Held**	18.28
Largest win	32617.77	**Largest loss**	-6236.78
# bars in largest win	4	**# bars in largest loss**	25
Net Profit %	953.48%	**Max. trade % drawdown**	-20.75%
Exposure %	62.53%	**Profit Factor**	1.94
Net Risk Adjusted Return %	1524.94%	**Payoff Ratio**	1.3
Annual Return %	60.19%	**Risk-Reward Ratio**	1.05
Risk Adjusted Return %	96.27%	**Sharpe Ratio of trades**	0.97

Table 6- back testing results, for using (tactic 3) for 5 years in New York Stock Exchange

New York Stock Exchange	01/01/2003 to 01/01/2008		Tactic 3 Statistics
All trades	**Net Profit %**	**Avg. Profit/Loss %**	**Avg. Bars Held**
131	577.39%	1.99%	10.48
Winners	87 (66.41 %)	**Losers**	44 (33.59 %)
Avg. Profit %	5.87%	**Avg. Loss %**	-5.69%
Avg. Bars Held	10.72	**Avg. Bars Held**	10
Largest win	9607.72	**Largest loss**	-9436.03
# bars in largest win	22	**# bars in largest loss**	4
Net Profit %	577.39%	**Max. trade % drawdown**	-26.78%
Exposure %	93.67%	**Profit Factor**	1.69
Net Risk Adjusted Return %	616.38%	**Payoff Ratio**	0.85
Annual Return %	46.58%	**Risk-Reward Ratio**	0.44
Risk Adjusted Return %	49.73%	**Sharpe Ratio of trades**	1.05

5.3 Testing Tactic 3

During downtrends, when bears are in control, it is unlikely that the VZO would reach the maximum bullish power zone (40). This means that the VZO will retrace from a zone below 40 (failure to reach the upper boundary). Accordingly, a sell signal is triggered crossing below the zero line.

Due to the bearish power in downtrends and the price's own weight, the buy signal was triggered by crossing above -45 instead of -40 as in the previous two tactics.

Reaching the overbought level in a downtrend means a great selling opportunity and adds one more selling signal by crossing the 40 level.

From the above, basically there have been two selling signals: one when crossing the 40; and the other when crossing below the zero level, with only one buying signal from crossing above the -45 level.

After any buy signal, if the VZO goes below -50, an exit signal is triggered.

To define the downtrends in the system, stocks below their 60-day EMA () were considered in downtrend.

As this oscillator depends on volume, the test was limited to stocks with their 15-day average volumes above 25000 shares.

5.4 Results Summary

Tables 7 and 8 show the results of using the three tactics of the VZO together for a five-year period.

Table 7- sum of using all VZO tactics for 5 years in Egypt Stock Market

Egypt Stock Exchange	**01/01/2003 to 01/01/2008**		**Sum of All Tactics**
All trades	**Net Profit %**	**Avg. Profit/Loss %**	**Avg. Bars Held**
301	8518.10%	4.76%	12.15
Winners	184 (61.13 %)	**Losers**	117 (38.87 %)
Avg. Profit %	9.78%	**Avg. Loss %**	-4.56%
Largest win	99668.34	**Largest loss**	-44150.55
# bars in largest win	30	**# bars in largest loss**	6
Min. trade % drawdown	-20.75%	Max. trade % drawdown	-27.56%
Avg. annual Return %	1703.62%	Avg. Sharpe Ratio of trades	1.31

Table 8- sum of using all VZO tactics for 5 years in New York Stock Exchange

New York Stock Exchange	**01/01/2003 to 01/01/2008**		**Sum of All Tactics**
All trades	**Net Profit %**	**Avg. Profit/Loss %**	**Avg. Bars Held**
381	1667%	2.78%	12.01
Winners	225(59.06%)	**Losers**	156(40.94%)
Avg. Profit %	6.12%	**Avg. Loss %**	-4.48%
Largest win	16878.01	**Largest loss**	-9436.03
# bars in largest win	29	**# bars in largest loss**	4
Min. trade % drawdown	-12.84%	**Max. trade % drawdown**	-20.35%
Avg. annual Return %	333.40%	**Avg. Sharpe Ratio of trades**	1.06

Part Six: Conclusion

Volume analysis is an area which invites greater investigation. This paper has utilised the separation of bullish and bearish volume to construct an oscillator to lead price moves.

The VZO is a complete system based on volume analysis which produces effective buy and sell signals during different kinds of trends and can highlight hidden strength and weakness in the market.

6.1 Advantages of the VZO:

- IPOs can be bought and sold during their early stages, since the VZO depends on volume and does not require a long history of data to give buy/sell signals.
- The VZO does not move on the price action, but on volume. Thus, it can trade uptrend, downtrend or sideways.
- VZO indicates selling pressure when shares are offloaded in a correction.
- Basing the oscillator on volume overlooks the spikes in prices.
- VZO is primarily used for intermediate or short-term trading purposes.
- All sell signals can also be used to short, and buy signals to cover.

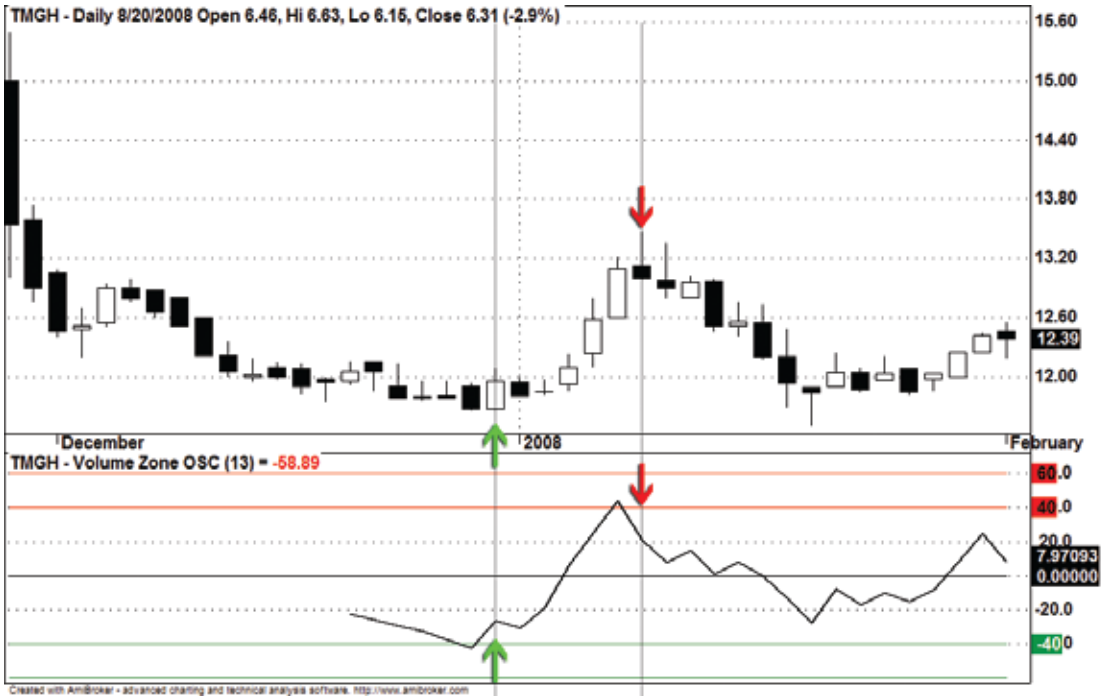
6.2 Disadvantages of the VZO:

- Not applicable to trade FOREX, because the volume data is delayed.
- Stocks hitting limit up or limit down will distort the volume Figure.
- The oscillator provides no price target.
- Sometimes the VZO fluctuates around the zero level causing whipsaws. IFTA

Software

All charts created with Ami Brocker, Advance Charting and Technical Analysis Software. www.amibroker.com

Figure 24 - Talat Mostafa Group Holding (TMGH.CA) Daily chart "Cairo Stock Exchange"



Optimising for the Highest Probability of Profit at Some Future Point in Time
A Prospect Theory Implementation for Portfolio Managers

by Ralph Vince

Abstract

Presented is a small Martingale approach to portfolio allocation, within a given drawdown constraint. Such an approach seeks to maximise the probability of being profitable at some given future point, as opposed to simply seeking to maximse profits. This is in direct contravention to not only mean-variance models, but geometric mean optimisation as well. However, maximising the probability of being profitable at some specified future point is consistent with the requirements imposed on most fund managers. Additionally, the small Martingale operating function presented, of quantity at risk to a multiple of an initial stake, is representative of the function evolution itself, as programmed into simians, for risk with respect to a multiple of an initial stake. Thus, the procedure presented is serendipitously consistent with the preferred investor behaviour regarding risk aversion posited in "Prospect Theory," and as such, ought to be psychologically easier for an investor or fund manager to implement and more satisfying to the investor or fund manager's clients.

Introduction

Often the maximisation of the geometric return is given as the primary criterion in portfolio construction and/or bet sizing (Bernoulli (1738), Kelly (1956), Latane and Tuttle (1967)). The author, as well, has provided a paradigm for money management based on geometric mean maximisation.

Geometric mean maximisation requires small anti-Martingale type progressions. They trade in quantity with respect to account size, increasing trading quantity as equity increases. They are *profit* maximisers, and hence have an equity curve that is mostly flat at best for very long stretches in time, and then tends to see enormous and rapid growth such that one can see exponential growth has occurred by the right-hand side of the equity curve.

On the other hand, in maximising the probability of profit, one is not concerned with geometric growth, nor even smoothness in an equity curve, but rather that at some future point (some "horizon" defined as a designated number of holding periods from the present one), the equity curve is above where it is today, plus some prescribed amount, with the highest probability. This requires a Martingale or small Martingale progression.

Typically, a Martingale doubles the bet size with each losing bet. As soon as the losing streak is broken, a one-unit gain is realised. The downside is that as the losing streak continues, the bet sizes double with each losing play, and eventually the required bet size is unachievable.

Typically then, Martingale and small Martingale-type systems suffer from larger drawdown than their opposing counterparts who trade in quantity relative to account size, such as geometric mean maximisation strategies.

The author has previously demonstrated a means of quantifying drawdown, allowing us to now use the constraint of drawdown as our risk metric[1], such that we may now employ a Martingale-style approach within the leverage space terrain – without the corresponding risk of larger drawdown that is usually inherent in such an approach.[2]

This paper attempts to demonstrate a procedure for a small Martingale progression for capitalising portfolio components, which seeks to maximise the probability of being at or above a given return by a specific future point, within the constraint of not exceeding a given probability of touching or exceeding a lower absorbing barrier through the duration towards that future point. This lower barrier may be fixed (i.e. "ruin") or allowed to float upwards as a percentage of equity increase (i.e. "drawdown").

Serendipitously, a small Martingale-type approach is consistent with the preferred investor behaviour regarding risk aversion posited in "Prospect Theory," (Kahneman and Tversky (1979)), and as such, ought to be psychologically easier for an investor or fund manager to implement. In brief, Prospect Theory asserts that humans have a greater tendency to gamble more under accrued losses (i.e. a small Martingale) in an attempt to maximise the probability of profit at a future point in time, whereas those confronted with profits seem to be more risk-averse,[3] save the rare, freelance madman who truly is a profit maximiser.

Given the propensity in humans to maximise the probability of profit at a given horizon in time, it becomes the fund manager's responsibility and preference to pursue that within a given drawdown constraint. In one of those rare conjugal visits of mathematics and human behaviour, this paper seeks to identify that function for probability of

profit maximisation versus risk, as both a tool for the portfolio manager as well as the mathematical operating function of human behaviour under conditions of risk and introduces the reader to ideas associated with the Leverage Space Model [i].

Algorithm & Formulas

If we have a variable, we call a "Martingale exponent," denoted as z greater than -1 and less than or equal to zero:

$$-1 < z <= 0 \quad (1)$$

We can then say that

$$1/(1+z) - 1 \quad (2)$$

Gives a result from 0 to infinity, as Table 1 demonstrates:

-z 1/(1+z)-1

Table 1: Approach—1

from the right	Approach infinity
-0.9999	10000
-0.999	1000
-0.9901	100
-0.98039	50
-0.97087	33.33333
-0.96154	25
-0.95238	20
-0.9434	16.66667
-0.8	4
-0.66667	2
-0.5	1
-0.37879	0.609756
-0.04762	0.05
-0.0099	0.01
0	0

Note that since we are going to be trading a small Martingale, we are not trading a fraction of our stake, so there is seemingly no *f* value for the components and hence no *f*$ value.

However, we do need a context, an initial capitalisation of a component, a scenario spectrum, and we will retain a consistent nomenclature and call this initial capitalisation the component's *f*$ (i.e. the amount we divide the current total capital of an account by to know how many 'units' to put on for the current position). And since we have an *f*$ for each component, and a scenario comprising the largest losing outcome for each component, we can discern an "initial f" value for each component (as that value wherein the absolute value of the outcome result of the biggest losing scenario divided by equals the *f*$).

$$| \text{Biggest Losing Outcome} | / f = f\$ \quad (3)$$

Thus

$$| \text{Biggest Losing Outcome} | / f\$ = f$$

Suppose we currently have $120,000 in equity. Further suppose we currently have on 300 shares of a given stock, and we determine that 1 unit is 100 shares. We thus have 3 units on currently — so we can say that our current *f*$ is $40,000, representing the amount we are capitalising a unit by. Lastly, suppose we know our largest losing scenario assigned to a unit of this stock is $10,000 (per unit, i.e. per 100 shares). Now we can determine our '*de facto*' *f* value as (always 0 >= *f* <=1):

$$| -10{,}000 | / 40{,}000 = .25$$

In an optimal *f* (LSP [i]) -style portfolio, regardless of the individual components, when the portfolio is up, more quantity is traded and vice versa. Similarly, but in reverse, we will trade more quantity on the downside for all components, while retaining their ratios to each other. This is the notion of diversifying risk, whereby stronger elements at the time support the weaker ones.

The process now proceeds as follows. At each holding period (i, of *q* holding periods), for each component (k, of N components), we adjust the *f*$ for the component that period as follows:

$$f\$_{k,i} = \frac{B_k / -f_k}{\left(\frac{acctEQ_0}{acctEQ_{i-1}}\right)^{\left(\frac{1}{(1+z)}-1\right)}} \quad (4)$$

Where:

$f\$_{k,i}$ = The amount to allocate to the k'th component on the i'th holding period.

BL_k = The largest losing scenario outcome for the k'th component, a negative number.

f_k= The initial *f* value (0<=*f*<=1) for the k'th component, based on its initial capitalisation

$acctEQ_0$ = The account equity before the first holding period (i.e. the initial equity).

$acctEQ_{x-1}$ = The account equity immediately before the current period.

z = The "Martingale exponent," value from (1).

We will employ two separate z values so that our function is consistent with that of Prospect Theory, which demonstrated empirically people's different risk preferences when they were "up" from a given reference point, as opposed to "down" from the given reference point.

Thus, we have a z value for when our stake is down from its starting value (i.e. a multiple on the starting stake < 1) and a different z value when the multiple on the starting stake > 1. We will call these values z_- and z_+ respectively.

Note in (4) at z = 0, the investor's capitalisation per unit remains constant (hence the investor is still trading less as his equity is diminishing). We can show these relationships graphically, and we will assume our initial *f*$ (when multiple = 1) is $1. This is demonstrated in Figure 1.

Thus, Figure 1 demonstrates that regardless of equity, at z=0 the number of units put on will always be the current equity divided by the same, initial *f*$ amount. So as the account equity diminishes, so too will the units put on and vice versa.

At z= -.5 the capitalisation is such that the number of units the investor trades in is constant. Thus, at z=-.5 the number of units he trades will always be the same regardless of account equity. This is demonstrated in Figure 2 on the next page.

When z <-.5, the investor begins to capitalise units with ever less amounts, thus incurring a Martingale-type effect. Again, since preferences among human beings seem to be a function of whether

Figure 1 $z_{-}=0, z_{+}=0$

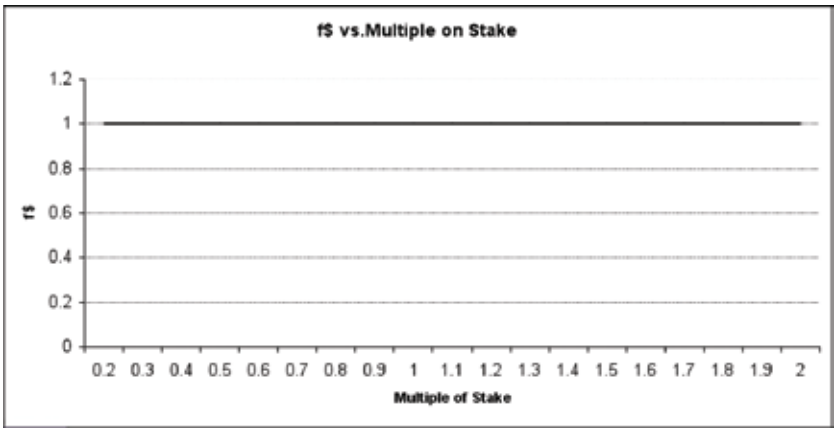


Figure 2 $z_{-}= -.5, z_{+}= -.5$

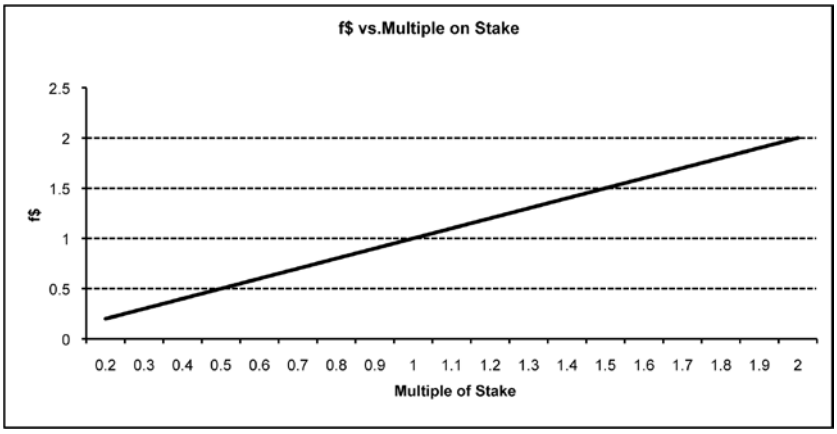
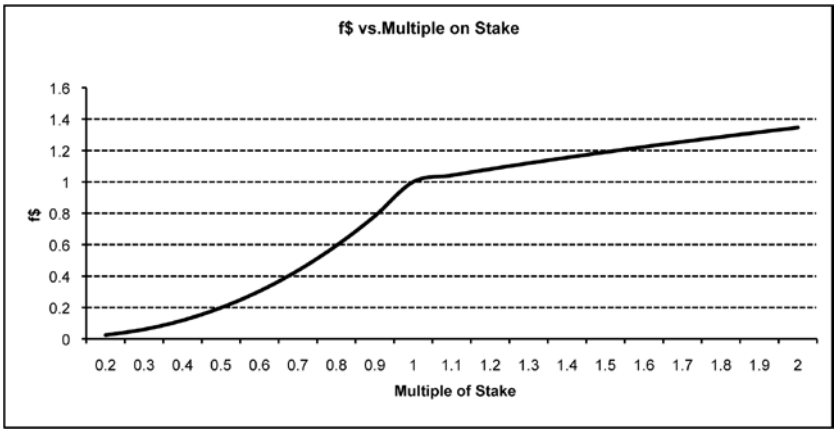


Figure 3 $z_{-}= -.7, z_{+}= -.3$



one is up or down from a given reference point (i.e. where multiple =1), we allow two separate z values to accommodate this very human propensity, though, as the previous two Figures demonstrated, these two values could be set equal to each other.

Figure 3 shows (4) in a typical, real life example of two separate z values.

Figure 3 begins to accomplish the small Martingale effect, innate in Prospect Theory, which seeks to maximise profits at a given future point. Figure 3 is shown in tabular form in Table 2

Table 2: Multiple *f*$	
0.1	0.004641589
0.2	0.023392142
0.3	0.060248966
0.4	0.117889008
0.5	0.198425131
0.6	0.30363576
0.7	0.435072961
0.8	0.594123371
0.9	0.782046402
1	1
1.1	1.041692943
1.2	1.081271659
1.3	1.11900716
1.4	1.155117866
1.5	1.189782789
1.6	1.223150769
1.7	1.255347099
1.8	1.28647841
1.9	1.316636313
2	1.345900193

It is the author's contention that (4) is the evolutionary, hard-wired function in humans pertaining to risk seeking and risk aversion and is consistent in graphical form with what has been posited by Prospect Theory[ii].

Given that this (4) is the evolutionary-wired preference in humans, a fund manager's "success" becomes a function of what degree he satisfies this preference in his clients.

Note that in a straight Martingale progression (betting 1,2,4,8,16, *ad infinitum* after a loss until a win is seen), only after a winning play is the account value up. For all other situations, the account is actually down most of the time, and often quite substantially if during a run of losing plays. Thus, a straight Martingale can be said to put an account up at some arbitrary point in the future, but not necessarily at some given point in the future.

Hence, the fact that the function (4) "breaks," at a multiple = 1, by virtue of having two separate Martingale exponents (z_{-} and z_{+}). Note that when an account is up, the bet size diminishes as a function of both the multiple on the starting stake and the Martingale exponent z_{+}. This part of the formula, consistent with the empirically observed

behaviour of Prospect Theory, permits a small Martingale progression the opportunity to retain profits efficiently until the horizon, the *given* future point (as opposed to the *arbitrary* one), is seen.

In (4), since $f\$_{k,i}$ = The amount to allocate to the k'th component on the i'th holding period, we can determine the number of units to trade for the k'th component on the i'th holding period as:

$$U_{k,i} = \frac{acctEQ_{i-1}}{f\$_{k,i}} \tag{5}$$

Dividing current equity by the *f*$ given in (4) for each component tells us how many units to have on for each component (1...N) at each holding period (1...q).

Simply put, we will now attempt to find the Martingale exponents (z_- and z_+) for the portfolio, and the set of f1...N for its components that maximise the probability of profit (PP) at some given horizon. Additionally, we can discern this with respect to a given probability of a given drawdown or risk of ruin, at that horizon point, per the technique given in Vince [i], with slight amendments provided at the end of this paper.

Note you trade more units when the account is down, and less when it is up. The Martingale exponents (z_- and z_+) are the levers that govern this. We will then seek those values for the Martingale exponents (z_- and z_+) for the portfolio, and the set of initial f1...N for its components so as to maximise the probability of profit, PP(r) at some given horizon, where r typically is 0. If, say, we considered "profit" as a 2% return at the horizon, we would say we seek to maximise PP(.02).

Note we can still calculate our TWR(f1...fN) ("Terminal Wealth Relative") as:

$$TWR(f_{1...}f_N) = \frac{acctEQ_q}{acctEQ_0} \tag{6}$$

Since TWR(f1...fN) is simply the multiple we have made on our stake after *q* holding periods.

Note a different scenario occurs at each holding period. We wish to maximise the probability of profit, PP(r) for a given r, over a given number of holding periods, *q*.

For the sake of simplicity, assume a coin toss wherein one of two possible scenarios, Heads or Tails, H or T, can occur. If we decide we are going to look at *q* = 2 holding periods, there are four possible branches that can be traversed, as follows:

H H
H T
T H
T T

Note in this case of two possible scenarios, and *q* = 2 holding periods, there are 4 possible branches of traversal [i].

Similarly, if we assume a portfolio of two coins, each with the same possible two scenarios of heads and tails, we look at

HH HH
HH HT
HH TH
HH TT
HT HH
HT HT
HT TH
HT TT
TH HH
TH HT
TH TH
TH TT
TT HH
TT HT
TT TH
TT TT

Each branch sees its own TWR (*f*1... *f*N) calculation from (6). Thus, for each branch, we can determine if:

$$TWR(f_{1...}f_N) - 1 \geq r \tag{7}$$

for that branch, and if so, we conclude that branch is "profitable." Thus, since we wish to optimise for highest probability of profit, we wish to maximise the ratio of the number of branches satisfying (7) divided by the total number of branches. This represents the "Probability of Profit" function, PP(r), which is what we seek to maximise by altering the Martingale exponents (z_- and z_+) for the portfolio, and the set of initial f1...N for its components .

The process for doing this, i.e. finishing at or above an upper absorbing barrier (at time *q*), is very similar to the process of determining drawdown, i.e. touching or exceeding a lower absorbing barrier (at any time 0...*q*). We use the branching process to determine this; yet, in determining the probability of profit, we are only concerned if the terminal leaves on the branching process are at or above r, unlike drawdown, where we are concerned if at any point along the branch, *b* has been touched on the downside. [i]

Thus, at each terminal node in the branch, we assess (7)

The calculation to determine the acctEQy at any point (1...*q*) is given as:

$$acctEQ_y = \sum_{i=1}^{y}\sum_{k=1}^{N}(U_{k,i} * outcome_{k,i}) \tag{8}$$

Where:

$outcome_{k,i}$ = the k'th component's scenario outcome at point i in the branching process.

Now we can look at the values at the terminal leaf of each branch and assess (7). Each branch has a probability associated with it; by taking the sum of these probabilities as our denominator and the sum of those probabilities for those branches that satisfy (7) as our numerator, we derive a PP(r) for a given Martingale exponents (z_- and z_+) and set of initial f1...N values which we are optimising over to determine greatest PP(r) within an (optional) drawdown / risk of ruin constraint.

Since the process of maximising probability of profit is an additive one (as opposed to maximising for profit, which is a multiplicative one), we must amend our calculation β [i]. We thus now have, if we are determining risk of ruin, RR(b) as:

$$\text{int}\left(\frac{\sum_{i=1}^{q}(acctEQ_i/acctEQ_0 - b)}{\sum_{i=1}^{q}\left|(acctEQ_i/acctEQ_0 - b)\right|}\right) = \beta \tag{9}$$

supplanting [12.03].

Given the propinquity of drawdown and ruin, we must adjust for the case

of Risk of Drawdown, RD(b), and supplanting [12.03a] we have:

$$\text{int}\left(\frac{\sum_{i=1}^{q}(acctEQ_i/\max(acctEQ_{0\cdots}acctEQ_i)-b)}{\sum_{i=1}^{q}\left|(acctEQ_i/\max(acctEQ_{0\cdots}acctEQ_i)-b)\right|}\right)=\beta \quad (9a)$$

Note that we can perform the calculation for both PP(r) and RX(b) simultaneously in the branching process per an algorithm [reference 2]. However, it must be pointed out that if the lower absorbing barrier, *b*, is seen while traversing a branch, the branch must still be fully traversed to determine (7). That is, simply hitting a drawdown on the branch does not permit one to abort the branch altogether; the branch must still be fully traversed so as not to sabotage the probability of profit calculation.

Conclusion

The paradigm for examining money management provided by the Leverage Space Model has afforded us an end separate from merely maximising geometric returns.

It should be pointed out that even though we seem to approach our allocations and leverage (referring to both manifestations of "*leverage*" [reference 2]; the immediate snapshot of ratio of quantity to cash, as well as how we progress that ratio through time as equity changes, intimating that leverage, in this second sense, is germane even to a cash account!) from an entirely different standpoint than the multiplicative one innate in geometric mean maximisation strategies (and thus innate in the Leverage Space Model), we are still somewhere on the terrain of leverage space, only moving along that terrain as our equity changes; the veracity and relevance of that model are unchanged. Rather, the technique described herein seeks to find a path through that terrain which maximises the probability of profit within a given drawdown constraint. (In fact, without the paradigm provided by the Leverage Space Model, such an approach would not have been feasible.)

People, including fund managers and individual investors, are not wealth maximisers. They are maximisers of probability of profit at some given horizon in time, as demonstrated empirically in Prospect Theory, and also further evidenced by the near-universal, visceral reaction exhibited towards the notion of mathematically optimal wealth maximisation afforded by geometric mean maximisation.

But neither the palette nor evolution itself dictates mathematics. Regardless of preferences and attitudes towards risk, everyone exists somewhere in the terrain of leverage space at all times. And as a paradigm, the Leverage Space model allows us to trace a path, see the results of our actions, to satisfy the (often seemingly pathological) palate of the individual, such as exhibited by Prospect Theory, which seeks not to maximise wealth, not to find the highest point in the leverage space landscape, but to trace a path through that landscape so as to maximise the probability of profit at a given future point in time.

Further, the Leverage Space Model, since it utilises the real-world risk metric of drawdown, now permits a small Martingale (demonstrated herein to model the risk preferences of Prospect Theory) to be implemented. We can determine, therefore, what our allocations and progressions of those allocations should be, i.e. our "path," through leverage space, so as to accommodate Prospect Theory's *implied* criterion of "maximum probability of profit at a given horizon in time" by determining those parameters that dictate our path.

We now have a method which allows fund managers to select a horizon in the future whereby they can maximise their probability of profit or of a minimum return, within a given drawdown constraint, in the context of the Leverage Space Model itself. IFTA

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Notes

1 Though the Leverage Space Model is presented as specifying risk as drawdown rather than variance in returns or some other ersatz measure of risk, it is feasible to incorporate these other risk measures, either in tandem with drawdown, or in solitary fashion, using the Leverage Space Model. For example, if a manager is indexed to a variance-based benchmark, such as the Sharpe Ratio, he *could* employ the Leverage Space Model, paring away those points on the terrain where either the drawdown constraint *or* his variance constraint was violated, thus making points that violate either constraint be unacceptable portfolio combinations.

2 In the Leverage Space Model if one is trading in a constant-unit size (as opposed to trading in size relative to equity), one is migrating towards the $f1...fn = 01...0n$ point in leverage space as the equity increases, and, similarly towards the $f1...fn = 11...1n$ point in leverage space as the equity decreases. Since we are always within the terrain of leverage space, whether we acknowledge it or not, the approach presented, i.e. a Martingale-style approach, can be said to be an approach which seeks a path through the terrain of leverage space itself. Hence, we see firsthand here how the Leverage Space Model is not merely a static model of allocation, but a paradigm for more dynamic-types of allocations as well.

3 The pervasiveness of this tendency in humans and other primates, Chen et al. (2006), is suggestive of an evolutionary cause, a hard wiring of a given function.

Optimisation of Trailing Stoplosses

by David Linton, MFTA

Abstract

Technical Analysts can greatly improve their trading results on virtually any chart by optimising their stops. Most technicians are familiar with the idea of a "trailing stop" or "stoploss." Optimising this simple tool to "best fit" the data for a given instrument will normally provide a better exit than most other technical indicators. Through comparison with several widely accepted technical indicators, the paper will show that Optimised Stoploss is a valid tool derived from price for exiting, and with the potential for, entering trades.

Introduction

The idea behind the trailing stoploss is simple. First, a number of points or a percentage, representing a small fraction of the price of an instrument, is set below the price such that it provides a price exit level or stop. With a trailing stop, the stop level rises (trailing the price) when the price rises and moves sideways when the price falls back from a peak. The trailing stop can only start rising again when the last high (where the trailing stop started to move sideways) is exceeded. The formula from a set low or entry of a position may be expressed as an expression or routine as follows:

Set SL=Price*(100-stop%)

If (Price*(100-stop%)>SL) SL=Price*(100-stop%) – i.e. raise stop level

If Price<SL then Exit Position

The weekly chart (Figure 1) of the S&P 500 Index below shows a trailing stoploss calculated on the closing level of each candle. Highs and intra-day breaches have been ignored here for clarity. On this chart, a stop level of 10% is set to start in October 1999, when the price was 984. This gives a stop level of 886, i.e. 10% below the price. Thereafter, the stoploss trails the price such that it moves up when the price moves to a higher closing level. In order to lock in profits, the trailing stop does not move down with the price at any time and instead runs sideways. For instance, once the price high at A is made, the trailing stop line runs sideways until a new high is made at B, where the trailing stop line starts to rise again.

The stoploss gives a signal when the price closes below the stoploss line. From the high set at C, the stoploss line goes sideways with no new high until it is breached with a close below the stoploss at D. In this case, the 10% stoploss, an arbitrary level that is often used by investors, worked well in identifying a safe retracement in the price in late 1999 and more importantly did its job in identifying the end of the trend in late 2000.

Advantages:

1. The extent of a loss can be set and kept small with the ability to run a profit.
2. It is a guaranteed exit when the price turns down. Other derived indicators may never give an exit signal while the price is deteriorating (i.e. RSI falling through 70, but 70 is never reached).
3. It is an objective mechanical system. Trend lines are more subjective in establishing a support level, and most technical indicators require a period to be set.
4. Trailing stops allow for sideways translation in the price action to occur by moving sideways with the price during a period of consolidation. In a congestion phase, periodic indicators can give false sell signals.

Disadvantages:

1. The user needs to set a percentage or points amount, and this may not be optimum.
2. A chosen level may not be appropriate for a given time horizon or instrument class.
3. Temporary breaches can occur with whipsaws or spiking, leading to being "stopped out."

Method

Using a stoploss that fits the data best

Figure 1

If a market is trending, it makes sense to use a stoploss that makes allowance for the regular retracements that occur in that trend. Figure 2 is a log scale chart of BSE Sensex 30 Index for the Indian stockmarket. If a 20% trailing stoploss had been used for this market, signals would have been given at A and B. At the other extreme, had 40% been used, past retracements have not come near this such that a future retracement in price would be greater than what is normal. The middle stoploss of 30% is much nearer the previous retracements in the trend.

With the use of a computer, it is possible to arrive at the best fit stoploss for a given instrument. This can be done by trial and error with different percentages or moving the stoploss line up and down until it is just touching the significant lows in the price line. It is also possible to arrive at the '"best fit" stoploss by testing each percentage level in the routine to find the best one. The primary input for this process is to establish a low point of a price trend from where the stoploss will start.

Using "Best Fit" Stoplosses on Charts of Indicators

The idea of arriving at the "best fit" stoploss for a price chart can also be extended to other charts, such as cumulative indicators (e.g. On Balance Volume) or Relative Strength charts. Figure 3 shows a German stock, Deutsche Postbank, which has a "best fit" stoploss of 23%. The chart in the bottom window is the share price relative to the German Dax Index. The "best fit" stoploss for this relative chart is 12%. This implies that around half the stock's price volatility can be attributed to the market and half to the stock itself. Stoplosses used on relative strength charts in this way can also give earlier signals than on the price. In this example, the stoploss was breached almost a year earlier on the relative chart than on the price chart.

Optimisation of trailing stoplosses

While the 30% stoploss has fitted the retracements in the BSE Sensex Index well in the last five years (Figure 2), it may not be the stoploss that has produced the most trading profits across the period. Profits could be further increased by exiting trades near tops and re-entering trades near bottoms within the trend.

Figure 4 shows the BSE Sensex with a series of four stops. Instead of using a single 30% stoploss to fit this trend all the way up, a 12% stoploss could be used to trade the trend for better profit results. This assumes an ability to enter near the bottoms within the trend,

FIgure 2

FIgure 3

FIgure 4

using a tool like a short term RSI. An exit signal at (a) is given with a re-entry at a lower price at (b). At (c), the optimised stop gives an exit at a higher level then re-entering at (d). The exit at (e) is not much higher than the re-entry at (f), but this is a small price to pay for the advantage gained at (a-b) and (c-d).

This process of "optimising" the stoploss could be continued further for more short-term trades. Assuming one could exit at the stop level and enter at each low identified after the stop, more trading profits could be made.

In order to conduct optimisation of any technical indicator, entry and exit points need to be defined. This applies to the optimisation of stoplosses for exit as well. The entry of the stoploss needs to be set in order to optimise the stop percentage for the best exit. Different entry points along the history will determine different exit points when optimising for maximum profit. Using another indicator for entry isolates and thus proves the benefit that optimised stoplosses can provide for the purpose of this paper.

For this exercise, RSI and optimised stoplosses have been tested on a series of currency rates. Looking at the British pound against the US dollar as an isolated example, the process starts by optimising the RSI period rising through the 30-level over a test period of 1,250 days (five years) to give good low points from which to optimise the stop percentage. For this optimisation, a range of RSI periods were tested from five days to 34 days with a step of one day, i.e. step through 5,6,7...33,34, to establish which period gives the earliest entry. Commission costs for each trade were set to zero. In the case of the British Pound, eight days on the RSI was optimum. This sets the entry signal for the trailing stoploss to start (8-day RSI rising through 30). Now the optimisation of a range of percentages can begin. The test is set to run from 1% to 5% with a step size of 0.25% - *i.e.* 1.0, 1.25, 1.5, 1.75....4.5, 4.75, 5 and establish which of these percentages gives the best overall profit over the test period. In this case it is 2.0%. These results are shown on Figure 5.

Figure 5 also highlights the fact that there may not be an exit signal at all with the RSI. For instance, the RSI picked the low where the trade is entered at (a) but the RSI fails to reach

Figure 5

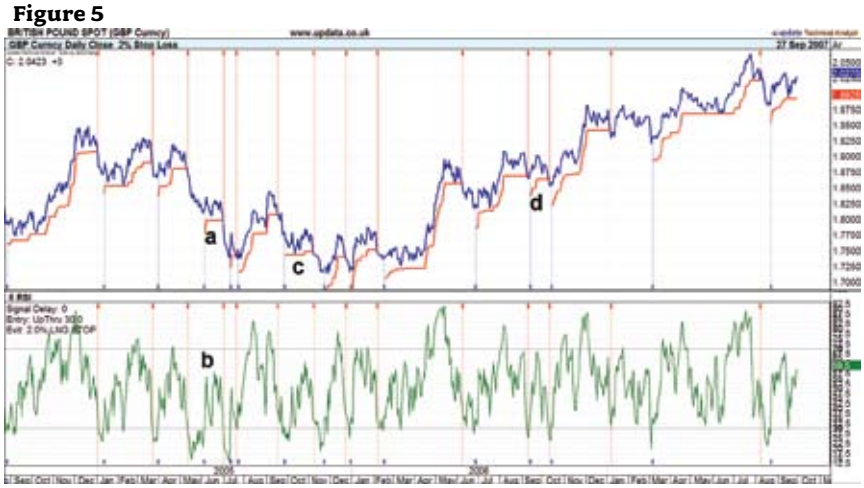

Table 1

Code	RSI Period	Entry Level	Exit	% Profit	% Chg	Diff	Trades	Draw Dn(%)	Ave Prof	Max Gain	Max Loss
AUD Curncy	7	30	1.75% LNG SL	50	56	-5	31	4	2	18	4
CAD Curncy	32	30	1.0% LNG SL	-4	-36	31	4	2	-1	0	2
CHFUSD Curncy	11	30	DnThru 70.0	28	23	5	10	6	3	6	3
CNY Curncy	34	30	1.25% LNG SL	-3	-9	6	2	1	-1	0	1
DKK Curncy	34	30	1.25% LNG SL	0	-27	27	1	1	0	0	0
EUR Curncy	9	30	2.25% LNG SL	34	38	-5	20	3	2	10	3
EURCAD Curncy	25	30	DnThru 70.0	8	-11	19	2	3	4	9	1
EURCHF Curncy	14	30	3.0% LNG SL	15	12	2	2	0	7	9	0
EURGBP Curncy	9	30	DnThru 70.0	16	8	7	15	5	1	3	3
EURHKD Curncy	8	30	4.75% LNG SL	30	38	-7	8	5	4	18	5
EURJPY Curncy	6	30	4.25% LNG SL	33	33	0	10	2	3	15	2
GBP Curncy	8	30	2.0% LNG SL	35	27	8	21	2	2	13	2
GBPAUD Curncy	16	30	2.75% LNG SL	11	-18	29	12	2	1	11	3
GBPCHF Curncy	26	30	DnThru 70.0	11	4	7	1	1	11	11	0
GBPJPY Curncy	12	30	4.5% LNG SL	32	22	9	11	2	3	12	3
HKD Curncy	30	30	DnThru 70.0	1	-1	1	1	0	1	1	0
JPY Curncy	19	30	DnThru 70.0	22	-4	26	4	4	6	12	0
MXN Curncy	19	30	DnThru 70.0	17	7	10	2	2	9	13	0
NOK Curncy	22	30	3.0% LNG SL	12	-24	36	7	4	2	8	4
NZD Curncy	7	30	1.5% LNG SL	38	46	-7	34	3	1	18	3
RUB Curncy	22	30	1.0% LNG SL	-2	-22	20	14	2	0	4	2
SEK Curncy	34	30	DnThru 70.0	9	-27	36	2	3	4	13	4
SGD Curncy	32	30	1.0% LNG SL	-1	-15	14	2	1	-1	0	1
ZAR Curncy	10	30	3.25% LNG SL	14	-21	36	29	5	1	17	6
Averages	**18**		**2.375**	**17**	**3**	**14**	**10**	**3**	**2**	**9**	**2**
5-34 RSI & 1 - 5 %SL			***A***	**16**		**13**	**12**	**2**	**2**	**8**	**2**
5-34 RSI No SL			***B***	**10**		**7**	**6**	**6**	**4**	**8**	**4**
5-34 RSI & 2.375%SL			***C***	**9**		**6**	**11**	**2**	**0**	**6**	**3**
18 RSI & 2.375%SL			***D***	**-4**		**-7**	**6**	**2**	**0**	**3**	**3**
18 RSI & 1 - 5 %SL			***E***	**3**		**0**	**7**	**2**	**2**	**6**	**2**

70 at (b). There is another example of this at (c) and (d), although the price did not fall as sharply here as at (a). Effectively the stoploss protects the trader if it transpires the RSI buy signal was, in fact, followed by a lower low.

So what difference did optimisation of the stops make in this instance over the 5 year test period? If an 8-day RSI with falls through 70 had been used to exit, the profit over the period would have been 16% versus 35% with the optimised stoploss exit. The currency itself appreciated 27% over the five years. Simply switching to a 2% stoploss for exits, instead of a fall through 70 on the 8-day RSI, doubled trading performance.

This optimisation exercise can be conducted across a range of instruments, as shown in Table 1 above. On 24 currency-cross rates, there are a broad range of RSI periods for entry and a choice of stoploss percentages for RSI for exit. It is worth noting here that, after conducting many optimisations across large instrument lists in various asset classes, optimisation results are not "normally distributed." This means using the average settings from all the optimisations on any individual instrument is unlikely to produce good trading profits. It is also interesting that the stoploss exit has been the better exit twice as often as the RSI when the optimisation could select between these two exit methods in terms of the one that produced most profit.

Looking at the Averages row toward the bottom of Table 1, it is seen that by optimising RSI periods and stoplosses, an average overall profit over the period of 17% is achieved. This is a long only trading strategy, where the 24 currencies changed 3% on average over the test period.

Following the rows below the Averages row, if one used:

A. Optimised RSI periods and optimised stops only (i.e. no RSI exit), the profit results only deteriorate by 1% to 16% (from 17%).
B. Conversely just optimised RSI for entry and exit (i.e. no stoplosses), the profit results deteriorate to 10% (down 7%).
C. An average stop percentage of 2.375%, profit results are 9%, showing profit is lost through not optimising stoplosses individually.
D. Using the average RSI period of 18 days and average stoploss produces a poor -4% overall loss, highlighting the fact that optimisation results are not normally distributed.
E. Using this same 18-day RSI and optimised stoplosses produces profits of 3% again, highlighting the improvement of optimising stoplosses individually.

The main message from these results in terms of optimised stoploss exits is twofold. Firstly, optimised stops work better than an RSI exit most of the time. Secondly, where RSI does work better, it is only slightly better (profit falls from 17 to 15% here), while when stoplosses work better, they tend to work a lot better (15% versus 10% profit for RSI). This has been confirmed as a general characteristic in many other optimisations of asset classes and timeframes. There is also the added danger of using a fall through a level (such as 70) that an exit signal may not occur when the price is falling heavily.

Table 2

STOPLOSS TIME HORIZON TABLE					
Term	Very Short	Short	Medium	Long	Very Long
Data (bars)	5 min	hourly	daily	weekly	monthly
Hold period	hours	days	weeks	months	years
Currencies					
SL % Range	0.1-1	0.5-2	1-5	3-8	5
SL % Step	0.05	0.1	0.25	0.5	1
Stocks					
SL % Range	1-5	5-10	7-15	9-18	10-20
SL Step	0.25	0.5	1	1	2
Stock Indices					
SL % Range	0.5-2	1-5	3-8	5-10	8-15
SL Step	0.1	0.25	0.5	1	1
Fixed income					
SL % Range	0.25-2	1-3	1-5	4-9	5-10
SL Step	0.05	0.25	0.5	1	1
Commodities & Futures					
SL % Range	0.1-2	0.5-3	1-7	3-10	7-20
SL Step	0.05	0.1	0.25	0.5	1

Optimised Stoploss, time horizons and instrument classes

Many market participants would identify a stoploss as too wide or too narrow for their needs. This may come down to asset class and a preferred time horizon. This also shows through in the number of trades over a test period. An average of 11 trades over five years would be too few for the short term trader and too many for the long term investor. Arriving at the best stoploss to use comes down to a few variables in setting the stop, apart from setting a criterion for entry. These are as follows:

1. The data time series being considered – daily, weekly or intra-day;
2. The range of percentages (or points/pips) to test – i.e. 3% to 8%; and
3. The step size of each stoploss in the test period – i.e. 3, 3.5, 4...7.5, 8 (0.5).

Table 2 gives an outline for these settings for different asset classes that work best in tests conducted. This is a rough guide, and there will always be exceptions. Different people will also have varying definitions of time horizons. Short term, for a trader and a long term investor, will have different meanings. While optimisation results are not normally distributed about a mean value, they do tend to fall into these ranges fairly consistently. There will be exceptions, but these generally appear to be the best settings to use for optimisation versus a given time horizon. These values were arrived at after running a series of optimisations of stoplosses on lists in each asset class. Some key points for each of them are:

- Currencies tend to have smaller ranges of values on multiple time horizons due to the high liquidity of this asset class. Retracements within trends tend to be smaller; and

FIgure 6

FIgure 7

FIgure 8

- Stocks can undergo much bigger retracements, especially if the time frame is very long term, i.e. an investor is prepared to ride out a bad year where there may be up to 20 percent retracement within the prevailing trend. Stocks can be less liquid and can react much more sharply to sentiment.
- Stock Indices will have smaller retracements than the underlying stocks because of the dampening effect of constituents moving in different directions. The weekly chart of the Hang Seng Index (Figure 6) shows how 4% has worked well over the period based on an RSI entry. This is unusual in that it is lower than the 5-10% normal stop value for a stock index on weekly data.
- Fixed Income stops are usually small because the price range is generally lower than most other asset classes. Figure 7 is a 5-minute chart for the German Bund future with optimised stops. The price range here is under 1% with a stop of 0.2%.
- Commodities have the widest variance with big moves possible in a day on certain instruments and much smaller moves in others.

Understanding temporary breaches and the start of a trend change

A common criticism of trailing stoplosses is that of temporary breaches, which lead to taking an early exit or being "stopped out." Optimising stoplosses reduces this dramatically by curve fitting the stoploss to the data series, such that breaches will normally be a sign of an "abnormal retracement in price." However, temporary breaches can still occur, and the best way to deal with this is by using a signal delay.

Firstly, the current bar for the time series used needs to be locked by the close for the signal to be truly given. It often proves valuable to wait a number of bars before taking a stoploss breach as a signal. It is possible to employ a strategy of waiting to just before the end of the period before accepting the signal. This would mean deciding to take a stoploss breach as a signal just before the close on daily data or ahead of Friday's close on weekly data. This strategy does not allow for the fact that prices may open above the stoploss in the next period but does deal with the risk of the price opening much lower once a stop has been breached. Signal delays of up to three bars may prove optimal.

Applying optimum signal delays anywhere between 0 and 3 on the 24 currencies already tested showed that a signal delay improved profits in thirteen cases and improved the overall profit average by 1.5%. The effect of a signal delay can often be much greater, particularly in individual instances where "spiking" may be more

commonplace. In Figure 8 of the US 10-year Treasury bond, optimisation has shown that it has generally paid to wait a day before exiting.

While the price may demonstrate a characteristic of bouncing back briefly after a stop breach, this can be dangerous especially with longer signal delay periods. With an optimised stoploss, abnormal retracements are being identified based on previous price history. When the price is below the stop, the risk of sharp falls in price is increased. The longer the price sits below a stop, such that it is now not a spike, the greater the level of risk that bigger falls are about to occur. Conversely, it pays not to be too eager to exit on a temporary breach.

In Figure 9, the Swiss stock UBS made the first intra-day breach of its long-term optimised stoploss at A. The extent of the shadow of this first breaching candle gave a measure for subsequent breaches. At B, the shadow below the stop is of much the same extent, but the price manages a close above the stop. At C, the shadow is well below the levels set at A and B, and the price even closes at the level of A and B. At this point, heading into the close with no realistic chance of a close above the stop, the trader may decide to exit. At candle D, the price opens lower still but not much lower. Either way at both C and D, the price is in fundamentally different territory than A and B. One point to note is that if the stoploss has been running sideways for longer than usual, the risk of bigger falls at the breach is increased by the fact that the potential consolidation period is longer than usual.

Measuring the true failure rate (where the price bounces back up through the stop) of optimised stoplosses is thwart with difficulty. Apart from remembering that the failure is a lost profit opportunity versus a potentially damaging real loss, the failure needs defining in a bigger context. This characteristic is shown using the Russell 2000 Index (Figure 10). The optimised stoploss is 4% with a signal delay of three days. On the first stoploss, the price goes higher at (b). Participants may point to the stoploss having failed at this point, but at (c), the chart fails to make a higher high than at (a) and then there is a sharper sell off. The same thing occurs at (d) and (e). It is worth noting that, due to the rising nature of the optimised stoploss, the stop level often corresponds to the previous significant low (as marked at (f)).

FIgure 9

FIgure 10

Using Optimised Stops in the field

While conducting optimisations and backtesting can provide a valuable insight into using stoplosses in a relatively short amount of research time, it is using them in practice over a long period that gives the true measure of their usefulness. Over a 12-month period to September 2007, optimised stoplosses were applied to all share tips given on British stocks in the UK press and various online tipping services. A degree of subjectivity was sometimes applied to the process in giving an optimised stoploss percentage to each of these tips at the time they were given. But the optimisation was mostly automated, and the results do provide further credence to the idea of using stoplosses as the ideal exit technique. There were 602 unique UK share tips given throughout the year and the summary results are:

- 244 stocks remain in the list as not having given optimised stop sell signals;
- The average increase in price since the date of each tip is 11%;
- 358 stocks tipped at any time in the last year have triggered their stops,
- The average decrease in price since the date of each tip is -10%; and
- The average decrease in price since the stop breach of each tip is -13%.

This is a much larger field test than the exercises conducted for this paper. While it is just for one instrument class, it does demonstrate that cutting losses early before they increase and running profits using optimised stoplosses works

FIgure 11

FIgure 12

Table 3

Averages SHORT	RSI Period	Entry Level	Short SL Exit	% Profit	% Chg	Diff	Trades	Draw Dn(%)	Ave Prof	Max Gain	Max Loss
5-34 RSI & 1 - 5 %SL	7	70	1.39	27	3	24	33	3	1	8	2

Table 4

	Trades	Equity	% Profit	Draw Down	Ave Prof	Max Gain	Max Loss	Gain/ Loss	No Wins	No Loss	Win/ Loss
Flip Flop Stoploss	100	16045	60	330	67	936	304	3	51	48	1
Parabolic SAR	116	15267	53	300	46	920	334	3	57	58	1
Directional Mov't	162	14589	46	253	29	935	278	3	82	78	1
Exponential MAs	102	14129	42	399	47	797	328	2	51	50	1
Bollinger Bands	54	13784	38	998	98	632	650	1	36	16	2
RSI	25	13275	32	1275	217	805	607	1	18	7	3
Commod Ch Index	85	13214	32	990	47	567	717	1	56	27	2

over the long term as a trading strategy.

Optimised Stoplosses for Short Selling

Optimised stoplosses can be applied equally well as an exit from short positions as well. Instead of looking for troughs in price for a long entry, peaks are used for short entry. The short stoploss now trails the price from above, falls each time the price makes new lows, and goes sideways with any upward movement from a low. The stop will only drop to new levels when new lows are made. Short stops are shown for American Express in Figure 11 and the formula set out at the beginning with the maths reversed.

Set SL=Price*(100+stop%)

If (Price*(100+stop%)<SL)
SL=Price*(100+stop%) – *i.e.* lower stop level

If Price>SL then Exit Short Position

For the 24 currencies that were previously optimised for longs using an optimised RSI period rising through 30 for entry and an optimised stoploss exit, there was an average profit of 15%. Conducting this same test but for short trading, an RSI fall through 70 and a short optimised stoploss exit produces an average of 27% (Table 3) even though the 24 currencies rose an average of 3% in the period. This highlights how counter trend moves using optimised stoplosses can provide even better profit opportunities than trading with the prevailing trend.

Optimised Stoploss as a trading system

Given that optimised stoplosses are an effective exit mechanism for long or short positions, it does raise the question: "Can optimised stoplosses be used for entry signals as well?" This would mean a long exit becomes a short entry and a short exit a long entry, hence "flip flop" flipping from one to the other. Due to the fact that the stoploss is a retracement measuring system from a high (long) or from a low (short), this means, by definition, that one never trades right at a trough or a peak. Nonetheless the system can be tested running a System Test of a "Flip Flop" stoploss. This simple tool works by swapping from a long stoploss to a short stoploss, such that a long exit becomes a short entry and a short exit becomes a long entry. Because the long and short values are parameters in the system test, they can each be optimised for the maximum overall profit in the test period.

In Figure 12, the "Flip Flop" stoploss is applied to Brent crude oil over a 5-year period. Here the optimum stops swap between 6.25% long (below the price) and 2% short (above). Commission costs were set to zero. The bottom window here is an equity line, and this demonstrates, that while crude oil rose from $22 to $78 over the period, $1,000 invested in this "Flip Flop" strategy became $6,400 – an outperformance of 285%.

So how does the "Flip Flop" match up against more traditional technical analysis indicators as a system to trade? Running optimisations on different Technical Analysis techniques as a Long-Short Strategy on the same 24 currency rates gives the results in Table 4.

This is by no means an exhaustive exercise, and only a handful of indicators have been chosen. In the case of exponential moving averages, the average periods were optimised between 5 and 34 with a step of 1, thereby covering 5 Fibonacci numbers in the process. The same range of periods was used for RSI (with levels of 30 and 70), Directional Movement, and Commodity Channel Index (levels -100 to 100) using the signals for flipping from long to short. In the case of Bollinger Bands, the standard deviation was kept constant, and only the periods were optimised (5 to 34) for a rise up through the lower band (buy) and fall through the lower band (sell). For parabolic SAR, the acceleration factor was optimised. In each case, optimised results came well within the range rather than at the edge, suggesting the right range was chosen. Many other indicators could have been used, but exit and entry signals would need to be decided, e.g. a signal line through a MACD.

The real purpose of this exercise is to show that optimised stoploss can stand up against a range of widely accepted indicators as a valid tool that is also derived from the price for exiting and possibly even entering trades. The statistics in Table 4 show that even though the Win/Loss ratio is low (roughly 50/50), the gains outweigh the losses by an average of 3 to 1. The character is quite similar to a Parabolic SAR, but with the benefit of being easier to administer in terms of keeping on top of exit levels and adjusting them as the price moves.

Conclusion

Optimised stoplosses are the ideal exit tool for technicians to use. Stoplosses that best fit the price data reduce being "stopped out" too soon. Conversely, the stoploss level is not too wide, giving away valuable percentages in profits in a downturn in price. The mechanism also allows for sideways translation in price during phases of price congestion when most other indicators would give false signals.

Optimised stoplosses can be applied to other charts, such as cumulative lines like On Balance Volume or Market Breadth measures. They can be used with relative strength charts too, and they clearly enhance trading results when used in conjunction with entry signals from other technical indicators. The tests show that optimised stoplosses are a more profitable exit mechanism than most exit signals given by other technical indicators. Trading results can be improved with the stoploss looking after the exit, such that indicators can be further optimised for entry without the burden of optimising for the exit as well. This idea of using a different mechanism to exit versus the technique for entering a trade is also a good trading discipline. Optimised stoplosses are simple and less subjective, which help to overcome the problem of a technician's analysis being biased towards the current trading position.

Optimised stoplosses also work across all time series of data for different time horizons and on any asset class where there is liquidity. Using a simple signal delay mechanism can improve the failure rate of being "stopped out" prematurely. A stoploss

trigger can often herald a lower high and eventual lower low. While a price back above a stoploss may be considered a failure initially, it may actually turn out to be a good early signal of a change in trend direction. As with all techniques, optimised stoplosses do have a failure rate. The studies here suggest this could be as high as 1 in 5 times, but it is the failure itself that needs to be considered. The failure is a lost profit opportunity rather than a real loss. This is one of the most powerful aspects of the optimised stoploss – the fact that it is a "guaranteed exit" in a way most other indicators are not.

The use of optimised stoplosses in extensive field tests on large universes of stocks has produced good overall results. On average, stocks that haven't triggered their optimised stops have continued to rise, while stocks that have given sell signals through their given stoplosses have fallen significantly.

Optimised stoplosses can be used equally well as an exit tool for short selling. There is even some evidence to suggest that swapping from a long optimised stoploss to a short one provides a good long/short trading strategy when compared with other optimisations of standard technical indicators.

Finally, optimised stoplosses are easier to apply for individual instruments going forward than values obtained from optimisations of technical indicators. Their application is less difficult as it is a much simpler derivative of the price –"normal retracement." They are more objective than resistance and support levels, and the prevailing stoploss price levels are easier to record and maintain with the passage of time. The optimised stoploss is a unique tool that is rooted in strong money management principles. Even with a win/loss ratio of less than 50/50, the fact that profits are allowed to run and losses are kept small means that overall trading results are greatly enhanced with their use. For this reason alone, optimised stoplosses should be seriously considered as a valuable tool for anyone using technical analysis techniques. IFTA

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Supporting Material (supplied)

RSI and Optimised Stoploss Calculation Spreadsheet; Flipflop Stoploss and Indicator Systems Spreadsheet; Tipstracker spreadsheets with live and sold tips for 12 months to Sep 30, 2007; and Flip Flop Stoploss — Custom Code (Updata programming language).

Can Technical Trading Systems Help in Volatile and Declining Markets?

by Fred K.H. Tam, MFTA

Abstract

In the light of the current super bull-run experienced in equity markets in Malaysia and all over the world, where stock prices continue to rise in a parabolic fashion, their propensity to reverse direction, leading to a sharp decline, becomes much higher. When these imminent market declines or corrections finally come to pass, can computerised technical trading systems, such as those tested in this study prove useful in assisting investors exit stocks? Can these technical trading systems help "save" the investor from imminent sharp declines and market losses, losses that could arise from using a buy-and-hold strategy? The results of this study reveal that the returns from technical trading systems exceeded that of the returns from a buy-and-hold strategy. This implied market inefficiency suggests that technical trading systems that rely on market data and historical information have value and can be exploited to make abnormal profits. The markets' inefficiency also suggests that fund managers, analysts and investors may want to use active investment strategies, like marketing timing, stock picking and sector rotation, to manage their equity portfolios rather than adopting a naïve buy-and-hold strategy. Of the thirteen trading systems tested, the top six systems found to have superior Sharpe ratios are: (1) the Channel Breakout (C.B.O.) system 20-5; (2) C.B.O. 20-10; (3) C.B.O. 15-5; (4) D.M.I; (5) 1-30 SMA; and (6) 3-7 EMA systems.

Keywords: technical analysis, technical trading systems, Sharpe ratio, random walk, market efficiency, transaction cost, Asian financial crisis, dotcom bubble, market volatility.

Introduction

Early researchers, such as Alexander (1961, 1964), Fama and Blume (1966), Van Horne and Parker (1967), and Jensen and Bennington (1970), conclude that technical analysis was not helpful in predicting U.S. stock market prices. These apparent failures are much clearer when transaction cost is included. However, in the late 1980s, a number of important research studies suggested that it is possible to make excess profits from technical trading analysis depending on the level of transaction costs incurred in trading activity (Sweeney, 1986).

Brock, Lakonishok and LeBaron (1992) confronted the efficient market hypothesis (EMH) by showing that moving averages and trading range breakout rules, two commonly used technical trading rules, have been successful in generating abnormal returns. Bessembinder and Chan (1995) examined Asian markets and found that Malaysia, Thailand and Taiwan produce profits from trading rules even after trading costs. Gabbi *et al.* (1999) used the moving average crossover as a technical trading rule for comparison with other trading techniques.

In Malaysia, a study by Liew, Lim and Choong (2003) examined the forecastability of ASEAN-5 stock market returns utilising linear and non-linear time series. The ASEAN-5 stock markets are Indonesia, Malaysia, Singapore, Thailand and the Philippines. Their results showed that the returns of the ASEAN-5 stock markets do not follow random walk movement; hence they are forecastable. The authors further concluded that, "this study can be taken as providing justification for the work of technical analysts."

In Singapore, Wong, Manzur, & Chew (2003) used test statistics to test a popular trend-following indicator, the moving average, and a counter-trend indicator, the relative strength index, on the daily data of the Singapore Straits Times Industrial Index (STII) from 1974 to 1994. Their results strongly suggested that technical indicators can be used to generate significant returns. They also found that member firms of the Singapore Stock Exchange (SES) tend to enjoy substantial profits using technical indicators and further concluded that, "this could be the reason why most member firms have their own trading teams that rely heavily on technical analysis."

Thus far, no studies have been attempted on the usefulness of using technical trading systems during periods of systematic declines and volatility, like that in the Asian financial crisis in 1997-1998 and the dotcom bubble in 1999-2000 on Malaysian stocks and Asian market indices.

This study is, therefore, a first in its category. Back tests are performed on thirteen popular technical trading systems on 38 Malaysian stocks and on eight major Asian stock indices over two volatile and declining periods, i.e. the Asian financial crisis and the dotcom bubble. The objective is to ascertain if technical trading systems can help "save" the investor from imminent sharp declines and market losses in volatile and declining markets.

Methodology and Hypotheses

This paper employs the filter trading rule methodology, similar to that of Lukac, Brorsen and Irwin (1988), to test for the profitability of technical trading systems. A trading rule specifies when a given security will be bought or sold. This rule is applied to a portfolio of securities, used as a proxy of the market, over a specified time period, and their returns are compared to a

naïve buy-and-hold strategy. A market would be viewed as weak-form efficient if trading rules simulation cannot produce returns greater than a naïve buy-and-hold strategy. When using the trading rules test, the return must take into account transaction costs and be adjusted for risk. These rules make no assumption about the distribution of returns but seek to establish whether a passive buy-and-hold strategy can be beaten by an active strategy like technical trading rules.

The performances of thirteen technical trading systems on the sample of 38 Malaysian stocks (see Appendix A) as well as the eight Asian stock indices (namely the KLCI (Malaysia), KCI (Korea), SET (Thailand), STII (Singapore), TWI (Taiwan), JKSE (Indonesia), N225 (Japan) and HSI (Hong Kong)) are simulated using the Metastock[1] software. For the testing of stocks, only long positions are permitted, whereas for stock indices, both long and short positions are permitted. The period designated to test for the Asian financial crisis is from July 2, 1997 to September 1, 1998, while the period designated to test for the dotcom bubble is from October 1, 1999 to May 31, 2000.

The thirteen technical trading systems tested in this study have pre-specified trading rules, which trigger buy and sell signals without regard to market fundamentals or personal judgment. The buy and sell rules used in each of the following thirteen systems to test the hypotheses are those that are either commonly used by analysts and investors in Malaysia or are advocated by the developer of the various systems. The thirteen technical trading systems are: (1) 1-30 dual simple moving average crossover; (2) 5-20 dual simple moving average crossover; (3) 3-7 exponential moving average crossover; (4) relative strength index (RSI); (5) momentum; (6) stochastic; (7) moving average convergence divergence (MACD); (8-12) five channel breakout (C.B.O.) systems, namely CBO 20-20, CBO 20-10, CBO 20-5, CBO 10-5 and CBO 15-5; and(13) the directional movement index (DMI).

The hypotheses tested in this study are as follows:

Hypothesis 1

$H1_0$: Gross returns (zero transaction costs) from trading systems cannot produce returns greater than the returns derived from the buy-and-hold strategy during the Asian financial crisis on 38 Malaysian stocks.

Hypothesis 2

$H2_0$: Net returns (after transaction costs) from trading systems cannot produce returns greater than the returns derived from the buy-and-hold strategy during the Asian financial crisis on 38 Malaysian stocks.

Hypothesis 3

$H3_0$: Risk-adjusted net returns from trading systems cannot produce returns greater than the returns derived from the buy-and-hold strategy during the Asian financial crisis on 38 Malaysian stocks.

Hypothesis 4

$H4_0$: Gross returns (zero transaction costs) from trading systems cannot produce returns greater than the returns derived from the buy-and-hold strategy during the Asian financial crisis on 8 Asian stock indices.

Hypothesis 5

$H5_0$: Net returns (after transaction costs) from trading systems cannot produce returns greater than the returns derived from the buy-and-hold strategy during the Asian financial crisis on eight Asian stock indices.

Hypothesis 6

$H6_0$: Risk-adjusted net returns from trading systems cannot produce returns greater than the returns derived from the buy-and-hold strategy during the Asian financial crisis on eight Asian stock indices.

Hypothesis 7

$H7_0$: Gross returns (zero transaction costs) from trading systems cannot produce returns greater than the returns derived from the buy-and-hold strategy during the dotcom bubble on eight Asian stock indices.

Hypothesis 8

$H8_0$: Net returns (after transaction costs) from trading systems cannot produce returns greater than the returns derived from the buy-and-hold strategy during the dotcom bubble on eight Asian stock indices.

TABLE 1 Summary of Mean Gross Returns (Zero transaction cost) from 13 Trading Systems on 38 Malaysian stock, Asian financial crisis (2/7/1997-1/9/1998)

No.	Trading System	Mean Gross Return (%)	Calculated *p*-value (1-tailed)
1	1-30 SMA	-5.74	0.158
2	5-20 SMA	-22.20	0.000***
3	3-7 EMA	-26.85	0.000***
4	RSI	-6.66	0.087**
5	Momentum	-8.83	0.0685**
6	Stochastic	-42.97	0.000***
7	Channel Breakout 20-20	-4.19	0.156
8	Channel Breakout 10-5	-18.92	0.000***
9	Channel Breakout 15-5	-1	0.413
10	Channel Breakout 20-10	1.82	0.322
11	Channel Breakout 20-5	3.68	0.154
12	MACD	-50.91	0.000***
13	DMI	-17.20	0.001***
	Buy-and-hold	-78.21	0.000***

Significance levels are denoted by * at the 0.10 level, ** at the 0.05 level and *** at the 0.01 level.

Hypothesis 9

$H9_0$: Risk-adjusted net returns from trading systems cannot produce returns greater than the returns derived from the buy-and-hold strategy during the dotcom bubble on eight Asian stock indices.

Two levels of transaction costs are tested in this study in order to determine the effect of transaction costs on trading rule returns. The first test was performed with zero transaction cost. The second test was performed with a brokerage fee of 0.44 percent for Malaysian stocks and 0.1 percent for Asian stock indices.

Results And Findings

Table 1 on the preceding page and Table 2 highlight the results of two tests of thirteen technical trading systems on 38 Malaysian stocks during the period of the Asian financial crisis from July 2, 1997 to September 1, 1998 based on zero and 0.44 percent transaction costs respectively.

Results from Table 1 reveal that all of the thirteen trading systems beat the buy-and-hold strategy, with eight trading systems significantly beating the buy-and-hold strategy at zero transaction cost. This result provides strong evidence against the first null hypothesis that stock prices are a random walk for Malaysian stocks during the Asian financial crisis period.

Results from Table 2 also reveal that all of the thirteen trading systems beat the buy-and-hold strategy at 0.44 percent transaction costs. Out of the thirteen trading systems tested, eleven systems significantly beat the buy-and-hold strategy. This result overwhelmingly rejects the second null hypothesis that no trading systems can produce returns above transaction costs, which is a traditional test of efficient markets for Malaysian stocks during the Asian financial crisis period.

In modern empirical studies on technical trading rules, any test of weak-form efficiency must account for risk as an efficient market is one that does not yield a profit above a return to risk. The results of the Sharpe ratio test (in Table 3) on 38 Malaysian stocks during the Asian financial crisis (after accounting for 0.44 percent transaction costs) reveal that all thirteen systems' risk-adjusted returns beat the buy-and-hold strategy, rejecting the third null hypothesis that no trading systems can produce risk-adjusted returns, which is the strictest test of efficient markets for Malaysian stocks during the Asian financial crisis period. As only long positions are allowed in the test of 38 stocks during the Asian financial crisis, no technical trading systems generated positive returns as reflected by their negative Sharpe ratios. However, all systems fair much better than the buy-and-hold strategy, which suffered a huge negative return of -78.31% and the worst negative Sharpe ratio of -6.78.

Results from Table 1, 2 and 3 provide strong evidence confirming the effectiveness of employing technical trading systems to time entry into and exit out of Malaysian stocks during the

TABLE 2 Summary of Mean Net Returns (0.44% transaction costs) from 13 Trading Systems on 38 Malaysian stocks, Asian financial crisis (2/7/1997-1/9/1998)

No.	Trading System	Mean Net Return (%)	Calculated *p*-value (1-tailed)
1	1-30 SMA	-14.20	0.06*
2	5-20 SMA	-28.84	0.000***
3	3-7 EMA	-38.95	0.000***
4	RSI	-15.43	0.002***
5	Momentum	-17.40	0.001***
6	Stochastic	-58.27	0.000***
7	Channel Breakout 20-20	-7.84	0.020***
8	Channel Breakout 10-5	-23.96	0.000***
9	Channel Breakout 15-5	-5.99	0.089*
10	Channel Breakout 20-10	-1.99	0.302
11	Channel Breakout 20-5	-0.59	0.431
12	MACD	-57.74	0.000***
13	DMI	-24.80	0.000***
	Buy-and-hold	-78.31	0.000***

Significance levels are denoted by * at the 0.10 level, ** at the 0.05 level and *** at the 0.01 level.

TABLE 3 Ranking of 13 Trading Systems based on the Sharpe Ratio, 0.44% Transaction Cost on 38 Malaysian stocks during the Asian financial crisis (2/7/1997-1/9/1998)

Rank	Trading System	R_{ts}	R_f	$R_{ts} - R_f$	σ_{ts}	Sharpe ratio
1	CBO 20-5	-0.59	6.08	-6.67	21.00	-0.32
2	CBO 20-10	-1.99	6.08	-8.07	23.40	-0.34
3	CBO 15-5	-5.99	6.08	-12.07	26.89	-0.45
4	1-30 SMA	-14.20	6.08	-20.28	33.06	-0.61
5	CBO 20-20	-7.84	6.08	-13.92	22.84	-0.61
6	RSI	-15.43	6.08	-21.51	29.73	-0.72
7	Momentum	-17.40	6.08	-23.48	32.47	-0.72
8	DMI	-24.80	6.08	-30.88	28.42	-1.09
9	CBO 10-5	-23.96	6.08	-30.04	22.08	-1.36
10	5-20 SMA	-28.84	6.08	-34.92	21.07	-1.66
11	3-7 EMA	-38.95	6.08	-45.03	15.65	-2.88
12	Stochastic	-58.27	6.08	-64.35	20.69	-3.11
13	MACD	-57.74	6.08	-63.82	19.92	-3.20
	Buy/Hold	-78.31	6.08	-84.39	12.45	-6.78

TABLE 4 Summary of Mean Gross Returns (Zero transaction cost) from 13 Trading Systems on 8 Asian stock indices, Asian financial crisis (2/7/1997-1/9/1998)

No.	Trading System	Mean Gross Return (%)	Calculated p-value (1-tailed)
1	1-30 SMA	40.04	0.023**
2	5-20 SMA	24.86	0.018**
3	3-7 EMA	34.60	0.014**
4	RSI	44.77	0.080**
5	Momentum	50.42	0.011**
6	Stochastic	30.54	0.038**
7	Channel Breakout 20-20	34.93	0.026**
8	Channel Breakout 10-5	24.82	0.014**
9	Channel Breakout 15-5	46.12	0.007***
10	Channel Breakout 20-10	36.86	0.007***
11	Channel Breakout 20-5	48.04	0.005***
12	MACD	1.58	0.453
13	DMI	50.50	0.003***
	Buy-and-hold	-24.77	0.044**

Significance levels are denoted by * at the 0.10 level, ** at the 0.05 level and *** at the 0.01 level.

TABLE 5 Summary of Mean Net Returns (0.1% transaction costs) from 13 Trading Systems on 8 Asian stock indices, Asian financial crisis (2/7/1997-1/9/1998)

No.	Trading System	Mean Net Return (%)	Calculated p-value (1-tailed)
1	1-30 SMA	35.89	0.033**
2	5-20 SMA	21.69	0.029**
3	3-7 EMA	27.30	0.028**
4	RSI	39.21	0.013**
5	Momentum	45.26	0.014**
6	Stochastic	15.53	0.135
7	Channel Breakout 20-20	33.67	0.029**
8	Channel Breakout 10-5	21.97	0.029**
9	Channel Breakout 15-5	43.83	0.009***
10	Channel Breakout 20-10	35.20	0.009***
11	Channel Breakout 20-5	46.09	0.006***
12	MACD	-1.61	0.45
13	DMI	46.34	0.003***
	Buy-and-hold	-24.66	0.044**

Significance levels are denoted by * at the 0.10 level, ** at the 0.05 level and *** at the 0.01 level.

TABLE 6 Ranking of 13 Trading Systems based on the Sharpe Ratio, 0.1% Transaction Cost on 8 Asian stock indices, Asian financial crisis (2/7/1997-1/9/1998)

Rank	Trading System	R_{ts}	R_f	$R_{ts} - R_f$	σ_{ts}	Sharpe ratio
1	DMI	46.34	6.08	40.26	49.01	0.82
2	CBO 20-5	46.09	6.08	40.01	53.16	0.75
3	CBO 15-5	43.83	6.08	37.75	53.84	0.70
4	CBO 20-10	35.20	6.08	29.12	44.22	0.66
5	Momentum	45.26	6.08	39.18	62.54	0.63
6	RSI	39.21	6.08	33.13	52.69	0.63
7	CBO 20-20	33.67	6.08	27.59	54.96	0.50
8	1-30 SMA	35.89	6.08	29.81	60.95	0.49
9	3-7 EMA	27.30	6.08	21.22	44.21	0.48
10	CBO 10-5	21.97	6.08	15.89	33.07	0.48
11	5-20 SMA	21.69	6.08	15.61	35.54	0.44
12	Stochastic	15.53	6.08	9.45	46.40	0.20
13	MACD	-1.61	6.08	-7.69	43.69	-0.18
	Buy/Hold	-24.66	6.08	-30.74	45.72	-0.67

Asian financial crisis.

Tables 4 and 5 highlight the results of two tests of thirteen technical trading systems on eight Asian stock indices during the period of the Asian financial crisis from July 2, 1997 to September 1, 1998 based on zero and 0.1 percent transaction costs respectively.

Results from Table 4 reveal that all of the thirteen trading systems beat the buy-and-hold strategy, with twelve trading systems significantly beating the buy-and-hold strategy at zero transaction cost. These results provide strong evidence against the fourth null hypothesis that stock prices are a random walk for Asian stock indices during the Asian financial crisis period.

Results from Table 5 also reveal that all of the thirteen trading systems beat the buy-and-hold strategy even after taking into account transactions costs of 0.1 percent. Out of the thirteen trading systems tested, eleven systems significantly beat the buy-and-hold strategy. This result overwhelmingly rejects the fifth null hypothesis that no trading systems can produce returns above transaction costs, which is a traditional test of efficient markets for Asian stock indices during the Asian financial crisis period.

The results of the Sharpe ratio test shown in Table 6 on the eight Asian stock indices tested during the Asian financial crisis after accounting for 0.1 percent transaction costs reveal that all thirteen systems' risk-adjusted returns beat the buy-and-hold strategy. This result refutes the sixth null hypothesis that no trading systems can generate a return above risk. As both long and short positions are allowed in the test of the eight Asian indices during the Asian financial crisis, all thirteen technical trading systems except for the MACD registered positive returns, and this is reflected in their positive Sharpe ratios.

The results from Tables 4, 5 and 6 provide strong evidence confirming the effectiveness of employing technical trading systems to time entry into and exit out of Asian stock indices during the Asian financial crisis.

Tables 7 and 8 highlight the results of two tests of the thirteen technical trading systems on eight Asian stock indices during the dotcom bubble

period from October 1, 1999 to May 31, 2000 based on zero and 0.1 percent transaction costs respectively.

Results from Table 7 reveal that all of the thirteen trading systems beat the buy-and-hold strategy, with five trading systems significantly beating the buy-and-hold strategy at zero transaction cost. This provides strong evidence against the seventh null hypothesis that stock prices are a random walk for Asian stock indices during the dotcom bubble period.

The results from Table 8 show that ten out of the thirteen trading systems beat the buy-and-hold strategy at 0.1 percent transaction costs. Out of the thirteen trading systems tested, two systems significantly beat the buy-and-hold strategy. This result rejects the eighth null hypothesis that no trading systems can produce returns above transaction costs, which is a traditional test of efficient markets for Asian stock indices during the dotcom bubble period.

Results of the Sharpe ratio test shown in Table 9 on eight Asian stock indices tested during the dotcom bubble (after accounting for 0.1 percent transaction costs) reveal that ten out of the thirteen systems' risk-adjusted returns beat the buy-and-hold strategy. This result rejects the ninth null hypothesis that no trading systems can yield a profit above a return to risk.

Results from Tables 7, 8 and 9 provide strong evidence confirming the effectiveness of employing technical trading systems to time entry into and exit out of Asian stock indices during the dotcom bubble period.

Conclusion

The objective of this study is to test the efficacy of technical trading systems in volatile and declining markets when compared with that of a buy-and-hold strategy. The two periods used in this test are (1) the Asian financial crisis and (2) the dotcom bubble.

The thirteen technical trading systems used in this test are: (1) 1-30 dual simple moving average crossover; (2) 5-20 dual simple moving average crossover; (3) 3-7 exponential moving average crossover; (4) relative strength index (RSI); (5) momentum; (6) stochastic; (7) moving average

TABLE 7 Summary of Mean Gross Returns (Zero transaction cost) from 13 Trading Systems on 8 Asian stock indices, dotcom bubble (1/10/1999-31/5/2000)

No.	Trading System	Mean Gross Return (%)	Calculated p-value (1-tailed)
1	1-30 SMA	11.23	0.035**
2	5-20 SMA	3.00	0.264
3	3-7 EMA	12.66	0.038**
4	RSI	11.73	0.015**
5	Momentum	10.04	0.063*
6	Stochastic	1.35	0.415
7	Channel Breakout 20-20	9.49	0.113
8	Channel Breakout 10-5	1.24	0.392
9	Channel Breakout 15-5	3.41	0.274
10	Channel Breakout 20-10	9.31	0.063*
11	Channel Breakout 20-5	6.40	0.116
12	MACD	1.76	0.401
13	DMI	8.13	0.131
	Buy-and-hold	0.78	0.444

Significance levels are denoted by * at the 0.10 level, ** at the 0.05 level and *** at the 0.01 level.

TABLE 8 Summary of Mean Net Returns (0.1% transaction costs) from 13 Trading Systems on 8 Asian stock indices, dotcom bubble (1/10/1999-31/5/2000)

No.	Trading System	Mean Net Return (%)	Calculated p-value (1-tailed)
1	1-30 SMA	9.55	0.056
2	5-20 SMA	1.57	0.369
3	3-7 EMA	8.81	0.089*
4	RSI	5.27	0.185
5	Momentum	8.17	0.104
6	Stochastic	-4.23	0.231
7	Channel Breakout 20-20	9.02	0.126
8	Channel Breakout 10-5	-0.16	0.485
9	Channel Breakout 15-5	2.37	0.355
10	Channel Breakout 20-10	8.61	0.075*
11	Channel Breakout 20-5	5.59	0.148
12	MACD	0.01	0.499
13	DMI	6.09	0.20
	Buy-and-hold	0.69	0.449

Significance levels are denoted by * at the 0.10 level, ** at the 0.05 level and *** at the 0.01 level.

TABLE 9 Ranking of 13 Trading Systems based on the Sharpe Ratio, 0.1% Transaction Cost on 8 Asian stock indices, dotcom bubble (1/10/1999-31/5/2000)

Rank	Trading System	R_{ts}	R_f	$R_{ts} - R_f$	σ_{ts}	Sharpe ratio
1	1-30 SMA	9.55	2.20	7.35	19.08	0.39
2	CBO 20-10	8.61	2.20	6.41	18.93	0.34
3	3-7 EMA	8.81	2.20	6.61	21.25	0.31
4	Momentum	8.17	2.20	5.97	21.19	0.28
5	CBO 20-20	9.02	2.20	6.82	25.77	0.26
6	CBO 20-5	5.59	2.20	3.39	17.64	0.19
7	RSI	5.27	2.20	3.07	18.32	0.17
8	DMI	6.09	2.20	3.89	24.10	0.16
9	CBO 15-5	2.37	2.20	0.17	19.20	0.01
10	5-20 SMA	1.57	2.20	-0.63	15.97	-0.04
11	MACD	0.01	2.20	-2.19	23.59	-0.09
12	CBO 10-5	-0.16	2.20	-2.36	15.28	-0.15
13	Stochastic	-4.23	2.20	-6.43	20.19	-0.32
	Buy/Hold	0.69	2.20	-1.51	18.69	-0.08

convergence divergence (MACD); (8-12) five channel breakout systems, namely CBO 20-20, CBO 20-10, CBO 20-5, CBO 10-5 and CBO 15-5; and (13) the directional movement index (DMI).

The conclusions of this study are as follows:

(1) The unanimous results rejecting all nine null hypotheses strongly confirm that the Malaysian stock market and the eight Asian stock indices are weak-form inefficient during the Asian financial crisis and the dotcom bubble period. This inefficiency implies that technical trading systems that rely on historical market data and information have value and can be exploited to make abnormal profits.

(2) In an inefficient market, security prices may not be providing accurate signals for capital allocation. This means that market prices may not be reasonable estimates of the underlying worth of the securities. Malaysian and Asian investors are unlikely to be paying "fair" prices for shares.

(3) Of the thirteen trading systems tested during the Asian financial crisis and the dotcom bubble, the top six systems found to have superior Sharp ratios are: (1) C.B.O. 20-5; (2) C.B.O. 20-10; (3) C.B.O. 15-5; (4) D.M.I; (5) 1-30 SMA; and (6) 3-7 EMA systems. These six trading systems are the most robust of the thirteen systems tested. Robustness implies that any investor that uses these systems to time the entry into and exit out of any Malaysian stock and Asian stock indices should reasonably expect to obtain positive returns.

(4) Of the top six trading systems, five systems come from either the channel breakout or the moving average family of systems. This finding concurs and is consistent with a study by Lukac and Brorsen (1990) published in the *Financial Review*, where they simulated 23 trading systems on 30 futures markets for the period from 1975 to 1986. Lukac and Brorsen's findings reveal that the channel breakout and the moving average systems are the top performers of the 23 trading systems tested and even suggested a channel breakout system as "the best starting point for technical trading."

(5) One of the top six trading systems is the Channel Breakout (C.B.O.) 20-10 system. This system is popularly known as the famous "Turtle" system developed by Richard Dennis [ii] in the 1980s. This study confirms that the Turtle system is as robust today as it was in the eighties. Investors applying the Turtles system for timing entry or exit on Malaysian stocks and Asian indices can reasonably expect to earn positive returns.

(6) This study has important implications for fund managers, analysts, investors and decision-makers in commercial enterprises, banking, insurance, national and state-owned funds and public limited companies. These bodies may want to consider using active investment strategies, like marketing timing, stock picking and sector rotation, and apply technical trading systems to manage their equity portfolios rather than adopting a naïve buy-and-hold strategy. Active investment strategies become especially crucial in fast rising and falling markets, like those currently being experienced all over the world. IFTA

References

i Metastock software

ii Richard Dennis is the legendary commodities trader who transformed US$400 to US$200 million (Market Wizards, p.85) in the 1980s. This trend following system was originally developed by Richard Donchian as the "four-week" rule but Dennis modified the parameters and named this modified system the Turtle system.

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Software

Metastock Software, Equis International, 3950 South 700 East, Suite 100, Salt Lake City, UT 84107, USA. www.equis.com.

Appendix A

SAMPLE OF 38 KLCI COMPONENT STOCKS USED IN THIS STUDY • BASED ON CUMULATIVE VOLUME FROM JAN 1996 — DEC 2002

STOCK CODE	SECTOR	NO.	COMPANY	PAID UP CAPITAL (RM'000)	FACE VALUE (RM)	MARKET VALUATION (RM'000)	CUMULATIVE VOLUME
1295	F	1	PUBLIC BANK BHD	3,197,386	0.5	18,615,179	55208217
1155	F	2	MALAYAN BANKING BHD	3,600,172	1	34,741,659	34509632
1961	PL	3	IOI CORPORATION BHD	579,813	0.5	8,929,128	30879100
1015	F	4	AMMB HOLDINGS BHD	1,823,439	1	5,652,662	20614232
5738	PR	5	COUNTRY HEIGHTS HOLDINGS BHD	275,699	1	330,839	9248980
4456	TS	6	TIME ENGINEERING BHD	765,029	1	730,603	8698764
3182	TS	7	GENTING BHD	352,169	0.5	11,692,027	8505913
1953	PL	8	GOLDEN HOPE PLANTATIONS BHD	1,051,732	1	3,723,133	8381371
3735	TS	9	MAGNUM CORPORATION BHD	779,066	0.5	4,331,604	7808564
4197	TS	10	SIME DARBY BHD	1,163,708	0.5	12,102,558	5790484
1066	F	11	RHB CAPITAL BHD	1,823,468	1	3,792,814	5357116
1562	TS	12	BERJAYA SPORTS TOTO BHD	892,328	1	3,622,853	4559091
5347	TS	13	TENAGA NASIONAL BHD	3,112,243	1	29,721,919	4432671
4863	TS	14	TELEKOM MALAYSIA BHD	3,244,708	1	27,255,550	4166889
3905	TS	15	MULPHA INTERNATIONAL BHD	697,206	0.5	655,374	3837851
3891	TS	16	MALAYAN UNITED INDUSTRIES BHD	1,940,532	1	572,457	3790085
4898	F	17	TA ENTERPRISE BHD	1,328,475	1	1,248,766	3787000
4529	IP	18	LEADER UNIVERSAL HOLDINGS BHD	436,459	1	277,151	3357350
2496	TS	19	MALAKOFF BHD	874,766	1	4,723,736	3280964
5398	CN	20	GAMUDA BHD	725,856	1	4,609,185	3139337
8664	PR	21	SP SETIA BHD	559,954	1	1,959,839	2688922
4677	CN	22	YTL CORPORATION BHD	737,293	0.5	6,370,212	2672097
2003	PL	23	KULIM (M) BHD	94,531	0.5	586,091	2593099
4405	CP	24	TAN CHONG MOTOR HOLDINGS BHD	336,000	0.5	866,880	2484949
5541	CN	25	ROAD BUILDER (M)HOLDINGS BHD	516,978	1	1,840,442	2312232
5819	F	26	HONG LEONG BANK BHD	1,580,107	1	8,216,557	2199771
4162	CP	27	BRITISH AMERICAN TOBACCO (MALAYSIA) BHD	142,765	0.5	12,420,555	2059622
3336	CN	28	IJM CORPORATION BHD	382,271	1	1,781,383	1883571
1473	PR	29	BANDAR RAYA DEVELOPMENTS BHD	476,378	1	1,024,213	1683910
2194	M	30	MALAYSIA MINING CORPORATION BHD	112,661	0.1	2,478,549	1564098
2267	TS	31	TANJONG PLC	£ 29,568	7.5p	4,257,783	1519563
3786	TS	32	MALAYSIAN AIRLINE SYSTEM BHD	1,253,244	1	6,015,571	1452096
1597	PR	33	IGB CORPORATION BHD	178,445	1	166,846	1441956
5304	CP	34	PERUSAHAAN OTOMOBIL NASIONAL BHD	549,213	1	4,640,850	1383518
1503	PR	35	HONG LEONG PROPERTIES BHD	350,229	0.5	406,266	1332588
3328	IP	36	HUME INDUSTRIES (M) BHD	166,463	1	873,928	1268650
6033	IP	37	PETRONAS GAS BHD	1,978,732	1	14,939,426	1190868
3999	TS	38	NEW STRAITS TIMES PRESS (M) BHD, THE	216,844	1	880,385	1175945
	TOTAL MARKET VALUE					247,054,973	

Fibonacci Retracements—A Dynamic Approach for Trend Indication and Optimised Trade Entry Timing

by Joerg Willig, MFTA

Abstract

There are various approaches to determine the beginning of new trends in the markets. The main difficulties are to avoid getting on the train too early and thus being vulnerable to whipsaws, and not to come in when the party is almost over, so that the pain of a sudden reversal would not be softened by a cushion of profits already made. There is no optimal solution, and every trader has to select the method fitting his personality and preferred trading style

To profitably trade with the trend, a trader has to determine a low-risk entry point. As markets will often retrace a part of a preceding move, a common approach suggests entering a position when such a pullback occurs. This process requires a methodology for measuring how far a certain pullback should reach before the prevailing trend is resumed. Various analysts and traders suggested different levels for these retracements, i.e. 1/3 or 2/3 of the preceding move, inverse powers and so on. Probably the best-known approach to calculate these levels is based on the Fibonacci ratio [i]. The Fibonacci methodology attracted my interest when I traded currencies, and I came to appreciate it as a powerful trading tool, particularly when it is used in combination with other methods like oscillator divergences. Working on trend following methodologies a lot, it occurred to me that it could be worthwhile to integrate the general idea of the Fibonacci ratios and a trend following approach.

This paper deals with dynamised Fibonacci retracements. After briefly introducing the general idea of the Fibonacci approach, the methodology of creating dynamic retracements is explained. To evaluate the practical value of this approach, a plain mechanical trading system based on dynamic Fibonacci retracements is introduced and back tested in various markets.

Introduction

As my work is based on the Fibonacci ratio, I will give a brief description of the main points of this approach.[ii,iii]

The Fibonacci Approach

Fibonacci numbers were first mentioned by Leonardo di Pisa, also known as Fibonacci, in his famous book *Liber Abaci* which was published in 1202. The infinite sequence of Fibonacci numbers is determined by a simple recursive equation. If fib(n) is the n-th element of the Fibonacci sequence and fib(1) and fib(2) equal 1, then the entire sequence is determined by:

fib(1) = 1; fib(2) = 1

fib(n+2) = fib(n) + fib(n+1)

resulting in the infinite Fibonacci series: 1, 1, 2, 3, 5, 8, 13, 21, 34, 55,...

When divided by its successor, every term of this sequence approximates the ratio 0.618. Dividing it by the next-but-one number results in approximately 0.382. The divergence of the results from these numbers gets smaller for later terms in the series. The example (Table 1) shows how the ratios converge on these numbers.

The values of 0.618 and 0.382 represent the main Fibonacci retracement levels. This means that, according to the Fibonacci approach, an intermediate correction should ideally retrace about 38.2% or 61.8% of the preceding move.

To obtain the corresponding pullback targets on a price chart, the analyst has to detect the absolute high and low of a past price move, calculate the Fibonacci ratios and draw them onto the chart. Figure 1 illustrates this process in an uptrend.

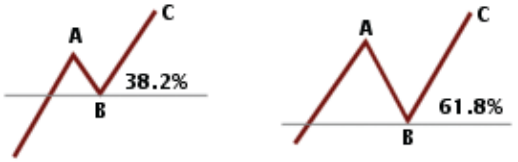
It occurred to me that it could be worth trying to change the way of applying these retracement levels in

Table 1: Convergence on Fibonacci ratios

n	Fibonacci series F(n)	ratio F(n)/F(n+1)	ratio F(n)/F(n+2)	
1	1			
2	1	1,000		
3	2	0,500	0,500	
4	3	0,667	0,333	
5	5	0,600	0,400	
6	8	0,625	0,375	
7	13	0,615	0,385	
8	21	0,619	0,381	
9	34	0,618	0,382	
10	55	0,618	0,382	
11	89	0,618	0,382	

convergence

Figure 1: 38.2 % and 61.8% retracements of a preceding upward move



my daily technical analysis. Aiming at an indicator capable of displaying the current trend, like a moving average of price data, but also revealing levels of support based on the structure of the movement, I started modifying the Fibonacci approach.

Method

The main difficulty with the dynamisation process is that one cannot simply calculate an average of time independent static levels inasmuch as these are determined only by the absolute high and low of a price move. There is no other option than to combine the general idea of a static retracement with a moving time window, so that a new kind of retracement level emerges - the dynamic Fibonacci retracement.

The Dynamic Approach

Bringing the time dimension into play means considering the static levels for a certain period specified by the analyst. This timeframe confines the price action from which the absolute high and low for calculating the retracement levels are chosen. By this means, the trader receives one set of static levels for each period. Moving forward one unit of time generates a new set of retracement targets corresponding to this specific point in time. To determine the look-back period, the trader may look at the parameter settings he applies when using other tools in his analysis, for example moving averages. This input may serve as a starting point. The parameter settings used in this paper serve exemplary purposes only and were chosen in order to clarify how the tool works. Figure 2 illustrates a shifting retracement level for two 10-day periods. While the lowest low is represented by the same candle, the highest high in period 1 is higher than the maximum of period 2. This results in a slight downshift of the retracement level in period 2.

Constantly calculating retracement levels and connecting the single data points lead to a more lucid representation of these levels, a line resembling a moving average. Figure 3 displays a chart with a single dynamic retracement line.

The first step in the process of building an indicator and programming it is to write down its mathematical representation. The equations defining the dynamic Fibonacci indicator are fairly simple. The parameters required are a specified time period, the highest high and lowest low of this period, and the percentage values which the analyst likes to determine the retracement levels.

Equation 1: Required parameters

p = time period

H_p = highest high of period p

L_p = lowest low of period p

perc^{up} = upper retracement parameter

perc^{down} = lower retracement parameter

These values determine the upper ($dynfib^{up}$) and the lower ($dynfib^{down}$) dynamic Fibonacci level given by:

Equation 2: Calculation of the dynamic levels

$$dynfib^{up} = H_p - (H_p - L_p) * \text{perc}^{up}$$

$$dynfib^{down} = H_p - (H_p - L_p) * \text{perc}^{down}$$

When the analyst sets the retracement parameters to 38.2% and 61.8%, the upper line of the indicator always represents the 38.2% dynamic retracement. Equation 2 clarifies why this is the case. The correction value is always subtracted from the absolute high of a move, hence the lower line invariably represents the 61.8% level (Figure 4). This may sound a little

Figure 2: Changing retracement values for two different periods (Bund futures, daily, Eurex)

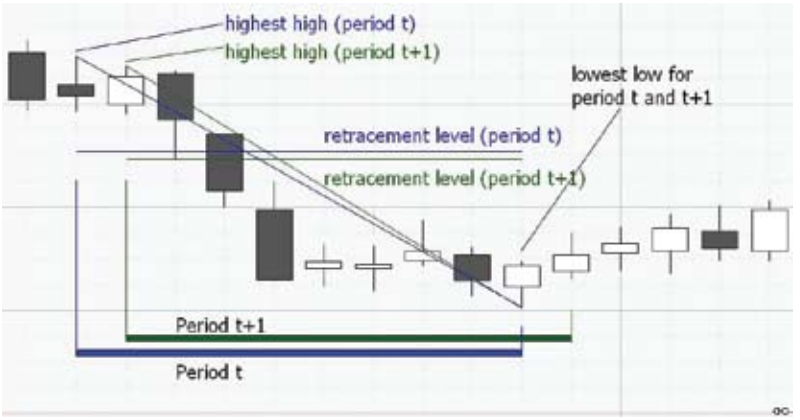


Figure 3: A single 20 day dynamic 38.2% retracement level (Bobl futures, daily, Eurex)

counterintuitive for a moment, but due to the symmetry of the indicator, it is more or less a question of naming and does not influence the application of the tool.

To avoid misconception, I usually refer to the levels as the upper (38.2%) and lower (61.8%) retracement line.

Apart from price and time, the trading volume provides the technical analyst with information, which may prove helpful in gauging the market internals of a certain move. To integrate this piece of information, the computation described above has to be altered. To create a volume weighted version, the calculation of the levels is adjusted by weighting each period's indicator value with the corresponding volume, and after that, dividing it by the accumulated trading volume of the entire look-back period. The addition of volume information requires the extra parameter *vol* to be included in the equations.

Equation 3: Integration of trading volume

vol_i = trading volume of period i

$dynfib_{\text{vol}}^{\text{up}}$ = volume-weighted $dynfib^{\text{up}}$

$dynfib_{\text{vol}}^{\text{down}}$ = volume-weighted $dynfib^{\text{down}}$

The calculation of the volume-weighted indicator lines is determined by the following equations:

Equation 4: Calculation of volume-weighted dynamic retracement levels

$dynfib_i^{\text{up}}$ = upper dynamic retracement (period i)

$dynfib_i^{\text{down}}$ = lower dynamic retracement (period i)

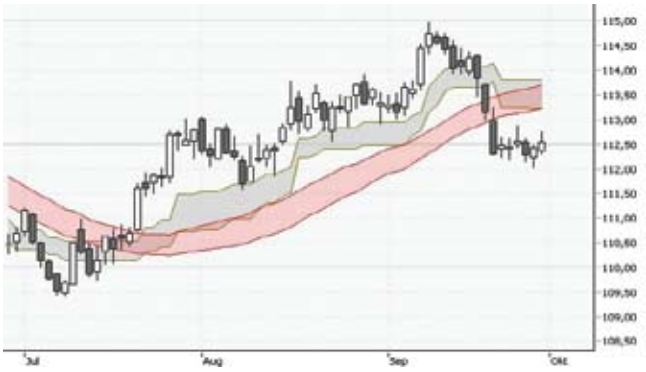
$$dynfib_{\text{vol}}^{\text{up}} = \sum_{i=1}^{p}\left(\frac{vol_i}{\sum_{i=1}^{p} vol_i} * dynfib_i^{\text{up}}\right)$$

$$dynfib_{\text{vol}}^{\text{down}} = \sum_{i=1}^{p}\left(\frac{vol_i}{\sum_{i=1}^{p} vol_i} * dynfib_i^{\text{down}}\right)$$

Figure 5 shows the application of both the plain and the volume-weighted version of the indicator, the latter being represented by the smoother red envelope.

Figure 4: Upper (38.2%) and lower (61.8%) 20-day dynamic retracement levels (Bobl futures, daily, Eurex)

Figure 5: Application of plain and volume-weighted 20 day dynamic levels (Bund futures, daily, Eurex)



At first glance the main difference between the plain and the volume-weighted indicator becomes obvious. Due to the weighting mechanism, the lines representing the weighted indicator show a notably smoothed movement closely resembling an envelope of common moving averages.

This smoothing implies a slower reactivity of the envelope to price action, so that the lines are usually further away from the price bars. This delayed response can be considered from two sides. It can be cheered because it brings with it the benefit of being less vulnerable to whipsaws, thus enabling the trader to profit largely during trending periods. This advantage comes at the cost of a more or less late entry into a trending market. Regarding short-term trading, the greater distance between the indicator and the price movement may well result in less potential for revealing short-term support and resistance.

Exemplary Application of the Dynamic Fibonacci Retracements

This section will show the exemplary application of the dynamic retracement indicator to the Euro Bund futures market (Eurex).

By using dynamised retracement levels, an indicator with some interesting properties emerged. It adjusts itself to the market action each day by considering in what way the parameters for its calculation have changed. By considering a certain look-back period, it aims at providing the analyst with both an indication of the prevailing trend and additional information about how far a retracement of a preceding price move in this specific timeframe should ideally reach. Thus the indicator displays

Figure 6: Indication of congesting and trending phases, 20-day dynamic retracements (Bund futures, daily, Eurex)

Figure 7: Exemplary trade using 20- week dynamic retracements (Bund futures, weekly, Eurex)

potentially low-risk entry points for initialising or increasing an existing position in direction of the dominant market direction.

The underlying price action can drive the indicator movement in two different manners. To rise, the indicator needs a new highest high or a higher lowest low. To fall, a new lowest low or a lower highest high is required. Each trading day, the calculation period is shifted one bar to the right (compare Figure 2). If the bar that drops out of the calculation has been the highest high or lowest low for this period or the bar entering the period under consideration is such an extreme point, then, and only then, the value of the indicator changes.

This implies that as soon as a trend halts and does not move further, the indicator commences to catch up with prices, as on the left side of the time axis, the extreme values start dropping out of the calculation, and on the right side, no new extremes enter the calculation.

If both the highest high and the highest low within the time frame under consideration stay the same, the indicator translates this market action into flat lines, denoting a phase of congestion (Figure 6).

These main traits of the dynamic Fibonacci retracements suggest the use of the indicator as a trend-following tool capable of pointing at important inflection points where pullbacks may cease.

The chart of the Euro Bund futures (Figure 7) illustrates a possible implementation of a simple strategy employing the 38.2% and 61.8% dynamic Fibonacci retracements for a 20-week look-back period.

An uptrend is said to begin when the price closes above the upper retracement line; a downtrend commences with the first close under the lower retracement line.

The circles indicate the first pullback to the closer retracement line, meaning a countertrend move up to the lower line if the market is in a downtrend or down to the upper line in an uptrend. The closing price below the lower indicator line at point A marks the beginning of a new downtrend, which directly takes the market lower for four weeks. This first sharp down move is followed by a congestion that lasts for six weeks, after which a sudden move takes prices up to the lower retracement level (point B). A stop sell order could be placed some ticks below the low of the last candle. The market then either takes the trader into a position or the setup dissolves when prices close above the upper indicator line. In case of the stop sell order being triggered, a position is entered when the market finally breaks down. The down move following the retracement turns out to be an impressive drop bringing the Bund futures down more than 500 basis points.

Of course not every trade will play out like this, but it illustrates a simple way of employing dynamic retracements. One important benefit of this tool is that it provides the trader with a built-in initial stop loss limit constituted by the more distant retracement line. The distance between the entry price and this line then defines the initial risk taken, excluding the inevitable gap risk. Once a position has been entered and the market starts moving, a closer trailing stop may be chosen.

As with any other tool the technical analysis toolbox has to offer, an addition of other auxiliary tools to provide confirmation or negation of trading signals can often significantly reduce risk and improve returns. Regarding my own experience with this tool in my daily trading, I came to appreciate the signals given by short-term oscillator divergences as a necessary confirmation for trade entries.

Many indicators look great when drawn on a chart. Sometimes this is

because the examined tool is indeed helpful; at other times, this effect is based on the selected time period or market, and sometimes it is just because the human eye blinds the analyst and leads to an overestimation of the profitability of the indicator-based signals. An objective way of analysing the usefulness of a technical tool is to back test it in various markets. To examine if the approach of dynamising retracements constitutes a good basis for building mechanical trading systems, I built a plain trading system and back tested it in various markets.

A Trading System Based on the Dynamic Fibonacci Approach

This section will focus on the creation of a trading system based on the dynamic Fibonacci approach. The purpose of this work is not the creation of a cutting-edge trading system; rather it should offer an objective evaluation of the respective system's properties.

The evaluation will consider a plain mechanical system implementing a stop and reverse trend-following approach that triggers signals when the daily price closes above (below) the upper (lower) dynamic retracement level. Once the opposite signal is generated, the current position is reversed. This trend-follower will be tested with both the simple version of the indicator and its volume-weighted variation.

Trading rules:

- Enter long and exit short at the next open when the price closes above the upper retracement line.
- Enter short and exit long at the next open when the price closes below the lower retracement line.

The only input required for the optimisation process is the look-back period. The system will regard all integer values between 10 and 100 days. To measure the usefulness of the system and to get an impression of its stability, I chose various markets to which the indicator would be applied. In the case of the futures markets, I used continuous contracts generated by a common algorithm. When open interest becomes larger in a back-month, the continuous contract switches from the current contract and moves to the back-month. This is not the only way to create these contracts but a rather convenient way leading to good results.

European Markets

- Euro Bund futures (Bund)
- Euro Bobl futures (Bobl)
- EuroStoxx 50 Index (ESTX)
- German DAX 30 Index (DAX)
- Spread: Bund-Bobl

US Markets

- T-Note Futures 10 year (T10)
- T-Note Futures 5 year (T5)
- Spread: T10-T5
- S&P 500 Index (SPX)
- Nasdaq Composite (CCMP)

System Evaluation

The system evaluation presented here will concentrate on the key Figures.

The system evaluation will display the following common statistics:

- Profit factor
- Number of trades
- Percentage of winning trades
- Largest loser/average winner
- Average bars in winner/average bars in loser
- K-ratio
- Sharpe ratio

To compare the relative performance of the plain and the volume-weighted approach, the above-mentioned Figures will be aggregated and then checked against each other. The results are shown in Table 3. In addition to these generally used performance statistics, a sensitivity analysis will show the sensitivity of the systems to variations of the parameter values.

It should be noted that the performance analysis takes no account of slippage and commissions and, therefore, leads to theoretical results, which are not influenced by these subjectively set factors.

Results

Considering the results altogether, not forgetting that the analysis is based on a very simple system, the dynamic Fibonacci approach seems to be a good basis for trend-following methodologies. Given the straightforwardness of the methodology examined, some results are quite encouraging.

The average profit factor of the system on all markets is 2.43 for the plain and 2.44 for the volume-weighted approach. The weighted methodology shows some superiority regarding the ratio of the largest loss to the average winning trade. The average Sharpe ratio of the system using the volume-weighted approach is the best by far, showing a value of 0.50. The K-ratios clarify that the approach is indeed not ready to use methodology.

The stability of the equity curves which is explained by this figure [iv] does not seem to be very impressive. Nevertheless, the numbers show that even by implementing a rather plain mechanical approach, relatively good theoretical results can be achieved. When arguing that the analysis treats optimised systems one should not forget that these methodologies are based on one single optimised variable.

The stability evaluation in Table 2 displays some interesting additional facts.

The system seems to be remarkably stable and capable of working profitably with a wide range of parameter settings. The results are significantly more stable when the system is applied to the bond futures markets and the corresponding spreads. Regarding the equity indices, the figures are still appreciable but by

Table 2: Rate of profitable parameter settings (plain and volume-weighted system)

	Profitable settings	
Markets	Plain system	Volume-weighted
Bonds (4 markets)	78%	89%
Equity Indices (4)	53%	53%
Spreads (2)	72%	68%
Weighted average	67%	70%

Table 3: Aggregated results (backtesting period: 01.01.2000-01.09.2007; US Notes and Spread: 01.12.2003-01.09.2007)

Trend-follower	Bund	Bobl	T5	T10	Bu-Bo	T10-T5	DAX	ESTX	CCMP	SPX	avg.
Lookback Period (opt)	23	83	19	34	18	12	33	95	59	18	39
# of Trades	78	22	50	28	114	79	57	25	28	124	61
Profit Factor	2,15	3,00	1,44	2,34	2,29	2,23	2,21	1,62	6,28	0,87	2,43
Percent Profitable	45%	41%	42%	43%	45%	54%	46%	40%	54%	31%	44%
Largest Loss/avg. win	0,98	0,46	0,99	0,70	0,94	1,72	0,92	0,92	0,43	1,65	0,97
Avg. bars in winner/loser	4,26	5,24	3,43	3,33	3,20	2,75	4,22	5,03	3,63	3,76	3,88
Sharpe Ratio	0,57	0,28	1,11	0,88	0,19	0,21	0,66	0,27	0,54	-1,22	0,35
K-Ratio	0,181	0,390	0,003	0,007	0,137	0,007	0,03	0,03	0,03	0,01	0,082

Trend-follower (volume)	Bund	Bobl	T5	T10	Bu-Bo	T10-T5	DAX	ESTX	CCMP	SPX	avg.
Lookback Period (opt)	16	61	12	24	18	20	29	97	21	96	39
# of Trades	62	18	44	24	128	32	35	11	54	20	43
Profit Factor	2,61	3,05	1,49	2,42	1,84	2,41	2,27	3,98	2,84	1,50	2,44
Percent Profitable	48%	44%	36%	42%	41%	47%	46%	55%	48%	30%	44%
Largest Loss/avg. win	0,77	0,43	0,82	0,59	0,97	0,76	0,85	0,42	1,73	0,80	0,81
Avg. bars in winner/loser	3,97	4,09	3,69	2,92	3,09	3,57	3,92	8,15	3,87	5,95	4,32
Sharpe Ratio	0,54	0,22	1,04	0,87	0,02	0,38	0,49	0,30	0,76	0,35	0,50
K-Ratio	0,157	0,016	0,003	0,005	0,001	0,001	0,02	0,05	0,03	0,01	0,030

no means as impressive as the other results. Again, both the plain and the volume-weighted systems show good characteristics.

Conclusion

This paper offers a good basis for further analysis. The ability of the dynamic Fibonacci approach to indicate an emerging trend in a timely manner is underpinned by the simple trading system.

The price chart in Figure 8 displays an example of the potentially helpful application of deviations of prices from the indicator lines. The lower panel displays the deviation of prices from a 20-day dynamic Fibonacci retracement. As divergences often constitute an early signal of price reversals[v], further research may be done on the possible application of divergences as a warning that a sustained trend may be ripe for a correction.

Since the indicator itself shows character traits of a moving average but also incorporates its own way of adapting to price action, it could be of additional value to push the envelope a little further and take tools, usually based on moving averages, and implement variations of them based on the approach depicted in this paper.

The results have shown the applicability of the dynamic Fibonacci approach as an additional tool in the trader's toolbox. Its main strength lies in the ability to quickly identify possible changes in market trends. In respect to the rather simple nature of the system tested in this paper it could be worthwhile to refine the approach to use its full potential. IFTA

Figure 8: Divergence of prices and an indicator (Bund futures, daily, Eurex)

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Software and Data

Software used in this study was Tradesignal 5 Standard Edition, SystemSoft GmbH, Bremen, Germany and Microsoft Excel 2000, Microsoft Corp., Redmond, USA.

End-of-day data provided by System Soft GmbH, Bremen, Germany

Author Profiles

"Technical Analysts can greatly improve their trading results on virtually any chart by optimising their stops. Most technicians are familiar with the idea of a 'trailing stop' or 'stoploss'. Optimising this simple tool to 'best fit' the data for a given instrument will normally provide a better exit than most other technical indicators."

Linton p.38

"Implied market inefficiency suggests that technical trading systems that rely on market data and historical information have value and can be exploited to make abnormal profits. The markets' inefficiency also suggests that fund managers, analysts and investors may want to use active investment strategies, like marketing timing, stock picking and sector rotation, to manage their equity portfolios rather than adopting a naïve buy-and-hold strategy"

Tam p.47

"By using dynamised retracement levels, an indicator with some interesting properties emerged. It adjusts itself to the market action each day by considering in what way the parameters for its calculation have changed."

Willig p.56

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Ralph Vince

Ralph Vince has worked as a programmer for numerous private investors, fund managers, professional gamblers and private trusts and has held the derivatives/forex chair for the Market Technicians Association (MTA) in the USA. In the late 1980s, Ralph began to detail his Optimal *f* notion for geometric mean maximisation and application in the financial markets and provided a scope and level of detail to geometric mean maximisation and the consequences involved in its ignorance, which lends a framework and rigor to money management. In quantifying drawdown along with geometric mean maximisation, his work has developed into the Leverage Space Portfolio Model, and he has utilised this framework to attempt to maximise the probability of profitability.

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Joerg Willig is a portfolio manager and works for a German bank in Frankfurt am Main, Germany. He is a graduate of the University of Hamburg, with a degree in business informatics. As a Chartered Alternative Investment Analyst (CAIA) and a Master of Financial Technical Analysis (MFTA), he has particular interest in systematic futures and options trading.

"In keeping with the fundamental shifts in 21st century global financial flows that move increasingly in favour of more faster growing 'emergent' economies, the foremost challenge to technical analysis is that it embraces the challenge of application, adoption and accommodation to the broadening church of our techniques."
Pontikis p.8

"An oscillator can be viewed as a high pass filter in that it removes lower frequency trends while allowing the higher frequencies components, i.e., short-term price swings to remain. On the other hand, moving averages act as low pass filters by removing short-term price movements while permitting longer-term trend components to be retained. Thus moving averages function as trend detectors whereas oscillators act in an opposite manner to "de-trend" data in order to enhance short term price movements."
Ehlers p.10

"Volume is always treated as a secondary indicator, despite its great importance in confirming trends and chart patterns."
Khalil p.18

"In maximising the probability of profit, one is not concerned with geometric growth, nor even smoothness in an equity curve, but rather that at some future point, the equity curve is above where it is today"
Vince p.33

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